for . . . .

engineers and contractors controlling the design, specification, installation and maintenance of heating, ventilating and air conditioning.

HEATING & VENTILATING

AIR CONDITIONING

PUBLISHER

THE INDUSTRIAL PRESS

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PUBLISHING INFORMATION

HEATING & VENTILATING is published monthly by the Industrial Press at 148 Lafayette Street, New York, N. Y. Western office, 228 North La Salle Street, Chicago, Ill. Yearly subscription in the United States, Spain, South America, Mexico, and Canada, $2.00; in all other countries, $3.00. Single copies 30 cents.

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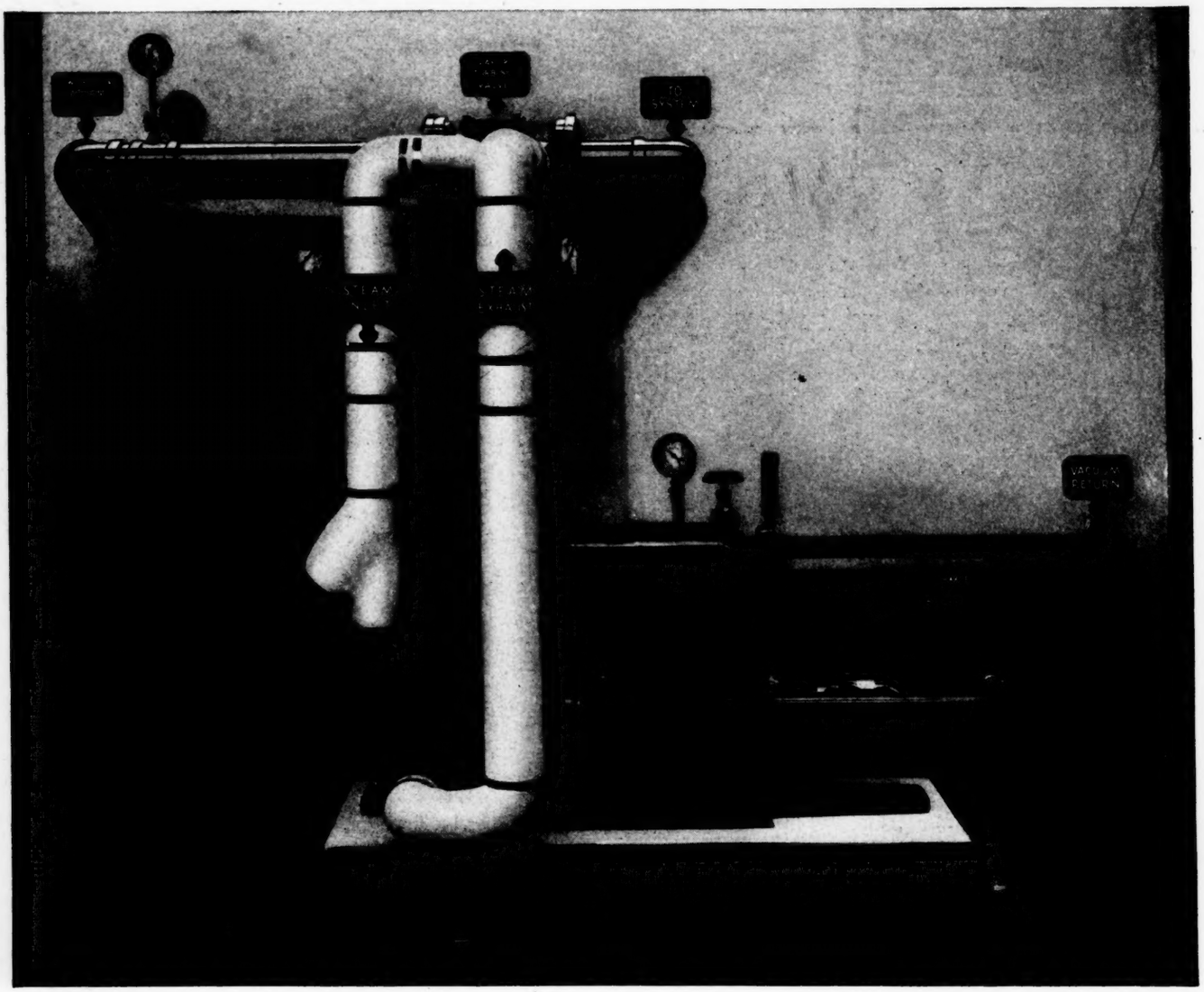

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The Venturi Ejector for Handling Air

PART 1—EXPERIMENTAL STUDY OF THE EJECTOR

By F. F. KRAVATH†

FOR a piece of equipment which has so wide an application, perhaps less has been written of the venturi ejector and its derivatives than about any other equally important piece of air using equipment. It is true that this subject has been touched on in the text of various previous articles, but the material has been too slight and, unhappily, almost identical. One manufacturer of air equipment has included in a very excellent book on air engineering what the writer considers to be the most valuable explanation of this device so far. However, due, probably, to enforced brevity, the information presented is limited, and falls short of answering the questions that a designing engineer is bound to raise. In an effort to arrive at the answer to many of these questions the writer conducted a series of experiments on what has come to be considered the most efficiently shaped venturi ejector. Since various engineers have previously determined what this shape should be (see Fig. 2), the writer's efforts were confined to extending existing information, rather than to refuting it.

Some of the questions which had always presented themselves are as follows:

(1) What is the effect of resistance at the induction side of the ejector on the induced air volume, air horsepower, and on the overall efficiency?

(2) What is the effect of varying the jet diameter at discharge into the ejector on the induced air volume, air horsepower, and overall efficiency?

(3) What is the effect of varying the jet discharge velocity, on the induced air volume, air horsepower, and overall efficiency?

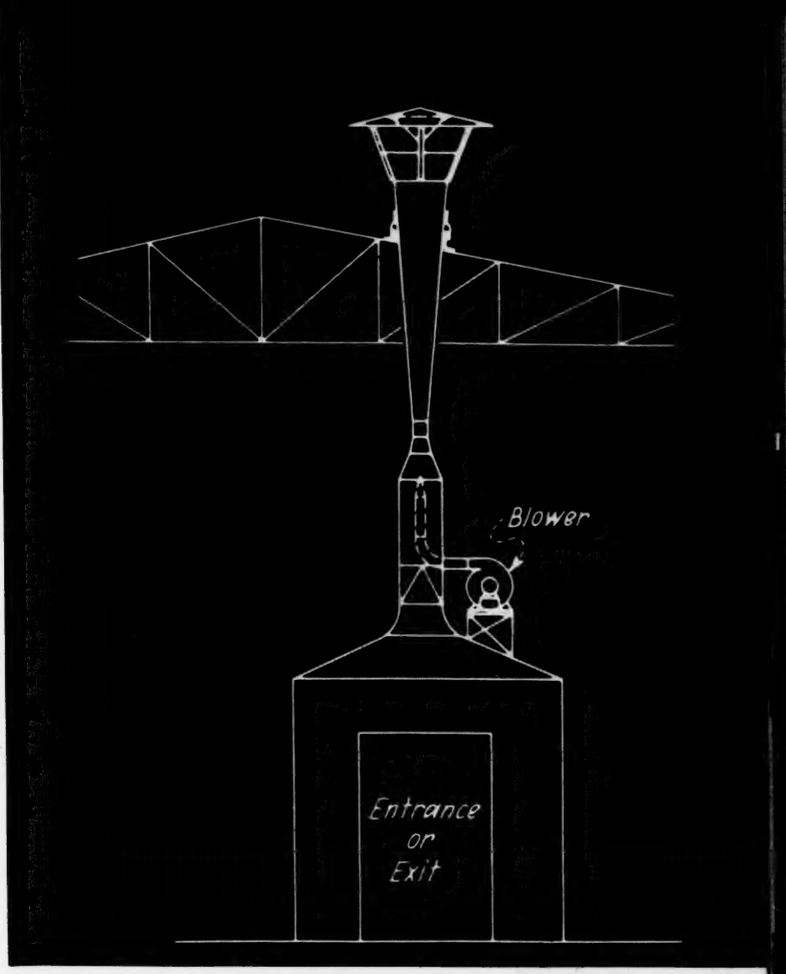
(4) What is the effect of resistance at the ejector discharge on the induced air volume?

(5) Can a formula be derived which will tie together the various vital elements such as induction resistance, discharge resistance, primary jet diameter, jet velocity, and induced air volume, so that for any set of conditions, the minimum jet horsepower would be supplied in order to maintain the desired induced air volume?

These questions and their answers will be taken up individually, and the experimental and theoretical material justifying the answers will be set forth.

In the course of the experiment the venturi tube illustrated in Fig. 2 was tested with various jet diameters, namely, 2-in., 4-in., and 6-in., over an extremely wide range of jet discharge velocities, three conditions of induction resistance and one of discharge resistance. The shapes illustrated in Fig. 2 as *Resistance A* and *Resistance B* were attached to the induction end as illustrated, while *Resistance B* was attached to the discharge end for a few tests. The blower supplying the jet air was a pressure blower capable of delivering air at a pressure of 1 lb. per sq. in. (blower total pressure). Readings of induced air velocity, discharge air velocity, and jet air velocity were taken with a velometer, wherever possible. Where jet velocities exceeded the range of the instrument, the equivalent of a Pitot tube was used. Checks on each reading taken were obtained, and in most cases were gotten with different instruments to avoid experimental errors.

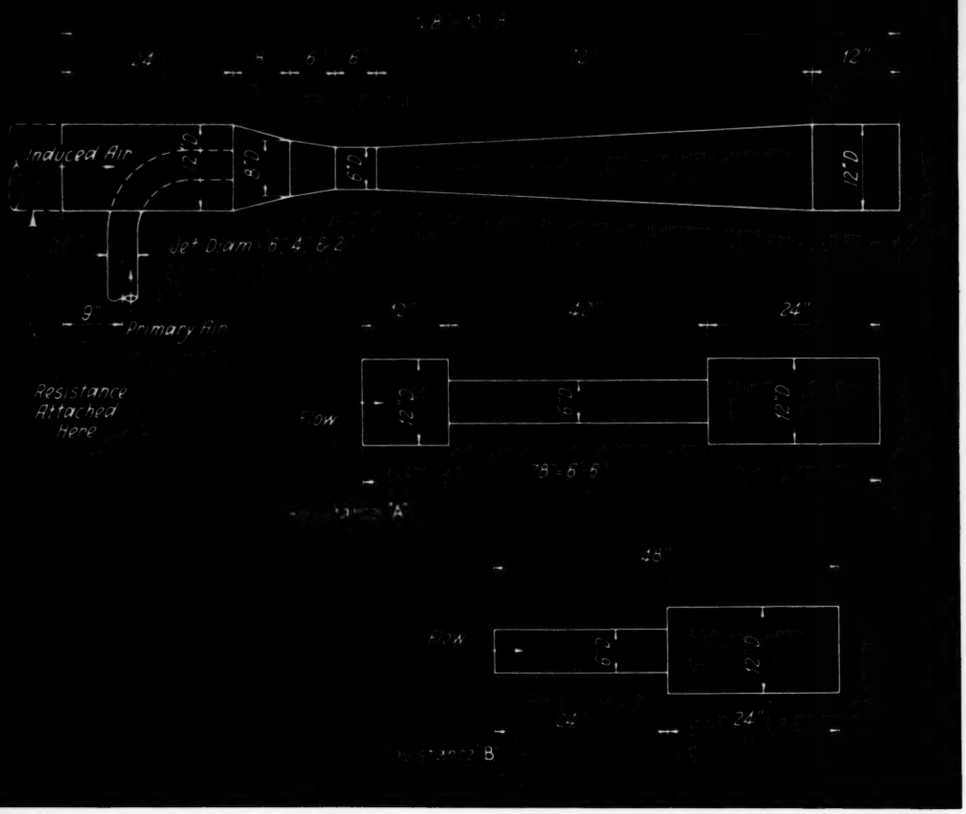
†Assistant Plant Engineer, Abrasive Company, Philadelphia.



1 VENTURI EJECTORS offer a safe, practical means of exhausting corrosive, explosive, hot or sticky gases without exposing the fan or motor to damage. Here is illustrated an application in a paint spray booth in which a stream of high velocity room air is inducing a considerably larger amount of fume laden air to be exhausted. Note that none of the contaminated air passes through the blower. Venturi ejectors have not been as widely used as they should, principally because of the lack of practical design information. In this article and in succeeding figures are presented the results of experiments conducted by the author to provide some of this needed information.

Effect of Induction Resistance, Jet Diameter, and Jet Velocity on Induced Air Volume

In Fig. 3 are the results obtained in varying the jet velocity in a 6-in. diameter, primary jet over a wide range. The experiment was conducted three times, once

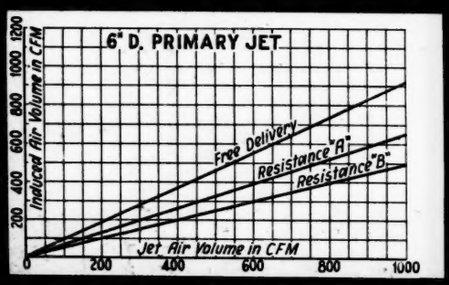


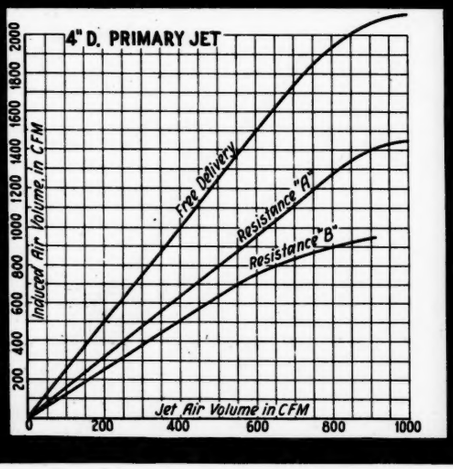
2 SINCE INFORMATION IS AVAILABLE on how to design the shape of the venturi ejector, the author's efforts were confined to extending existing information. Particular attention was paid to determining the effect of changes in resistance, in the jet diameter, and in the jet discharge velocity. Here is shown the venturi tube which was used in the tests. Jets of 2-, 4-, and 6-in. diameters were tested. Shapes A and B shown were used to vary the induction and discharge resistance.

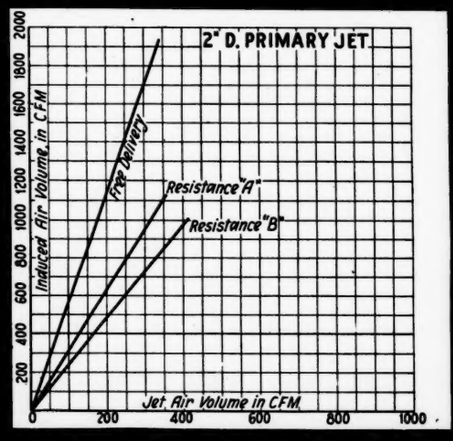
3 TESTS OF THE 6-IN. DIA. JET showed that the amount of air flow induced by the jet air was slightly less than the volume of the jet air, that the induced air flow was directly proportional to the amount of air passing through the jet, and that as resistance was applied, the induced air flow decreased.

4 INDUCED AIR FLOW increased two and one-half times when the jet diameter was decreased to 4-in. It was also found that at higher jet velocities the amount of air flow induced no longer was directly proportional to primary air flow. Resistance caused a greater decrease in flow than was noticed with the 6-in. jet.

5 DECREASING THE JET DIAMETER to 2-in. caused the jet to induce six times as much air as the 6-in. jet and two and one-half times as much as the 4-in. jet. Of interest is the fact that at free delivery with a 2-in. jet, the jet air caused an induced air flow of five and one-half times its own volume.



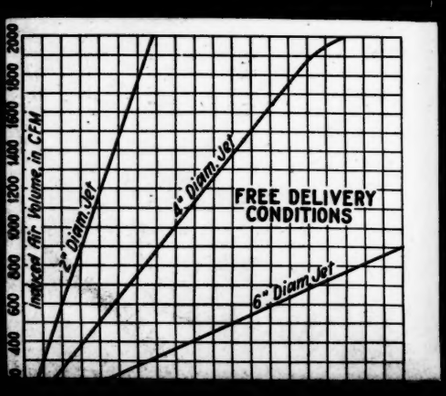


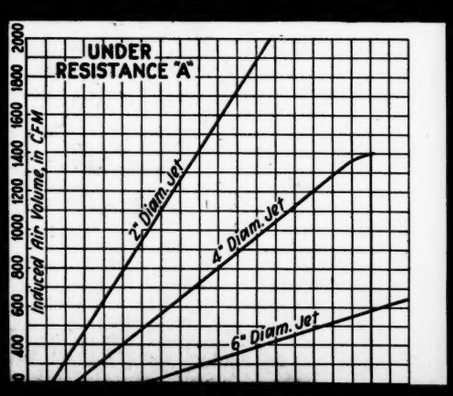


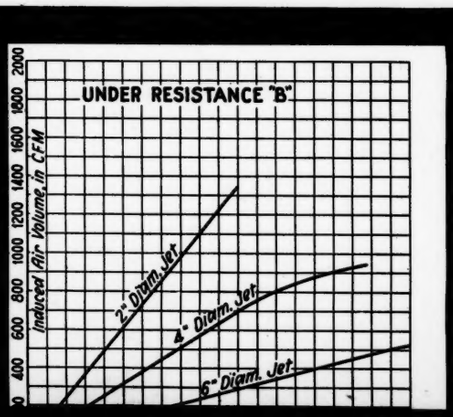
6 THE SUPERIORITY OF THE 2-IN. JET over the 4- and 6-in. jets is indicated in this graph. The three jets are compared under identical conditions and when operating with practically no resistance in the induced circuit.

7 HERE IS A COMPARISON of the three jets when delivering air into an induced circuit having a resistance A. The 2-in. dia. jet is still superior to both the 4- and 6-in. jets, but the relative superiority has been somewhat decreased.

8 THE AMOUNT OF AIR induced by the three jets when operating under the induced circuit resistance B is shown here. It will be noted that the 2-in. diameter jet is still superior to the 4- and 6-in. jets but that its superiority is further decreased.







with the ejector inlet free from additional resistance, and once each with resistances *A* and *B*. One very apparent result is that the induced air volume is virtually a straight line function of the jet volume. It is true that at the extreme upper limit of each curve there is a tendency to level out, but as will be seen from the subsequent curves, this tendency becomes more marked with increased induced air velocities, leading to the assumption that at the higher velocities surface irregularities incident to the venturi tube fabrication are more than the usual square function of the pipe velocity.

As would be expected, resistance applied on the induction side of the ejector resulted in a decrease in induced air volume. The greater the resistance, the less the induced air. Thus, for a fixed jet volume such as 800 c.f.m., the induced air at free delivery is 740 c.f.m., with resistance *A* it is 522 c.f.m., and with resistance *B* it is only 400 c.f.m. Resistance very definitely reduces the volume of air induced, while for any fixed shape induced air varies almost directly with the jet volume.

Fig. 4 illustrates the effect of the same resistances on the induced air volume over a wide range of primary jet volumes—this time for the 4-in. diameter jet. The curves are essentially the same, the chief difference being that the volumetric efficiency is much superior where the smaller jet is used, and that the levelling-out effect is more pronounced. Again, the addition of induction resistance results in a decreased induced air flow, this time to a more marked degree. Examining the curves, it is seen that for a jet volume of 800 c.f.m., the freely induced air is now 1945 c.f.m., while under resistances *A* and *B*, 1270 c.f.m. and 900 c.f.m., respectively are induced. The volumetric efficiency with the 4-in. jet is approximately 250% of that of the 6-in. jet.

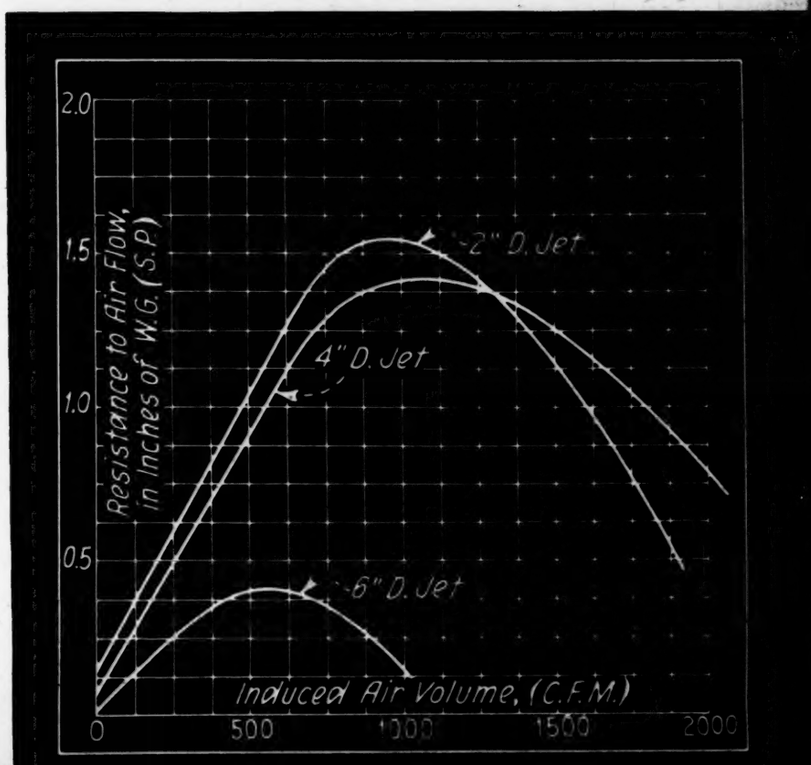
Fig. 5 presents similar curves for a 2-in. jet. The curves again are substantially the same except that they are much steeper indicating a still more favorable volumetric efficiency. Of great interest is the fact that at free delivery it is possible to induce an air volume of approximately 5½ times the volume of the jet air. Naturally this is cut down under resistances *A* and *B*, but under identical conditions, the 2-in. jet induces 600% of the air that the 6-in. jet does, and 250% the volume of the 4-in. jet. Fig. 6 illustrates the three jets compared under identical conditions. Here, under free delivery the difference in volumetric efficiencies is strikingly apparent. While in Figs. 7 and 8, the difference is equally apparent, as we increase the induction resistance, the relative superiority of the smaller jets decreases somewhat.

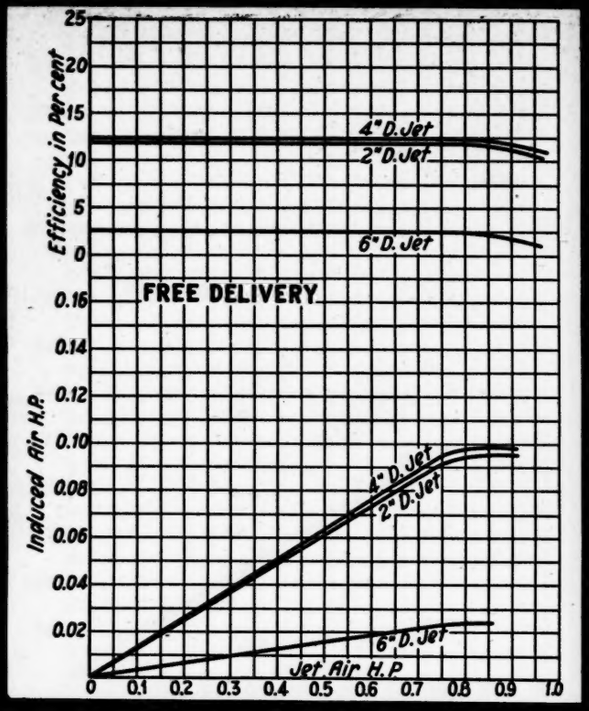
Fig. 9 shows the effect of resistance on the induced air volume for a constant jet volume. Starting at the right side of the curves under relatively free delivery conditions, we get the maximum induced airflow. As resistance is added the volume flowing is naturally cut down. The resistance builds up to a peak at which the greatest static efficiency is realized from whence further increase in resistance decreases flow to such an extent that the static pressure actually falls. Increased resistance results in the same phenomenon until as we approach a closed pipe condition (blast gate being gradually closed), practically no flow exists and hence, the minimum value of the static pressure. It is significant that a static pressure does exist, even at no induced volume. If this were not so, there would exist no accelerating force or pressure to cause inward flow. It is the rarefaction of the air immediately behind the jet discharge that causes the denser, heavier atmospheric air to flow inward. The paradox lies in the fact that as more air enters the tube, the mixing efficiency increases, the static pressure at jet discharge increases and more air is induced to enter. However, the increasing frictional resistance encountered in the pipe and at entry eventually causes a balance point to be reached, from which no additional air can be induced unless a greater volume of jet air is introduced.

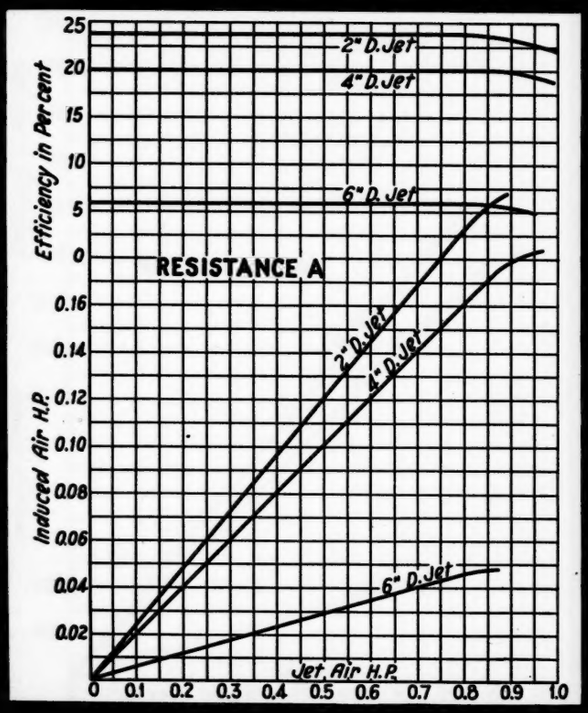
Horsepower and Efficiency Characteristics

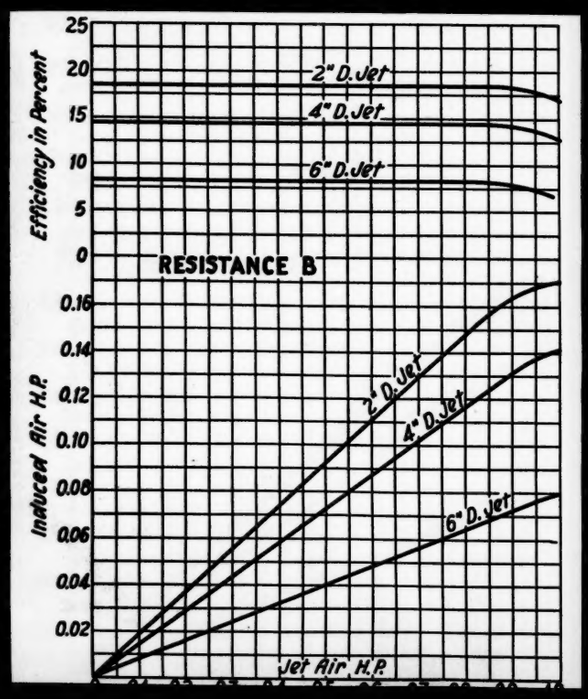
Since it was necessary to use some standard by which the results obtained in these experiments could be compared with future works of this nature, the jet air horsepower was figured at the nozzle tip only, neglecting the power consumed in forcing the blowing air up to that point against frictional resistance, etc. This was done because, each individual application of the ejector may have an entirely different arrangement of the various integral parts due, perhaps, to physical characteristics of the building, hood design (see Fig. 1), or some other pertinent reason—all of which would necessarily result in different resistances in the blowing duct and hence, different values of jet air horsepower, even for the same jet discharge velocity and diameter. Efficiencies in these

9 THE EFFECT OF RESISTANCE on the flow of induced air is shown in this graph. It will be noted that under relatively free delivery conditions, the flow of induced air is at a maximum. As resistance is added, the induced air is naturally cut down. As the resistance increases, the static pressure of the induced air also increases until it reaches a peak. Any further increase in resistance decreases the flow to such an extent that the static pressure actually falls. As a closed pipe condition is approached practically no flow exists and there is a minimum value of static pressure.









tests will appear a trifle higher than is normally attainable because of the foregoing explanation.

Fig. 10 reveals the horsepower and efficiency characteristics of the venturi ejector operating under free delivery conditions and using the 2-in., 4-in., and 6-in. diameter jets. Since both the jet air horsepower and the induced air horsepower are based on the formula

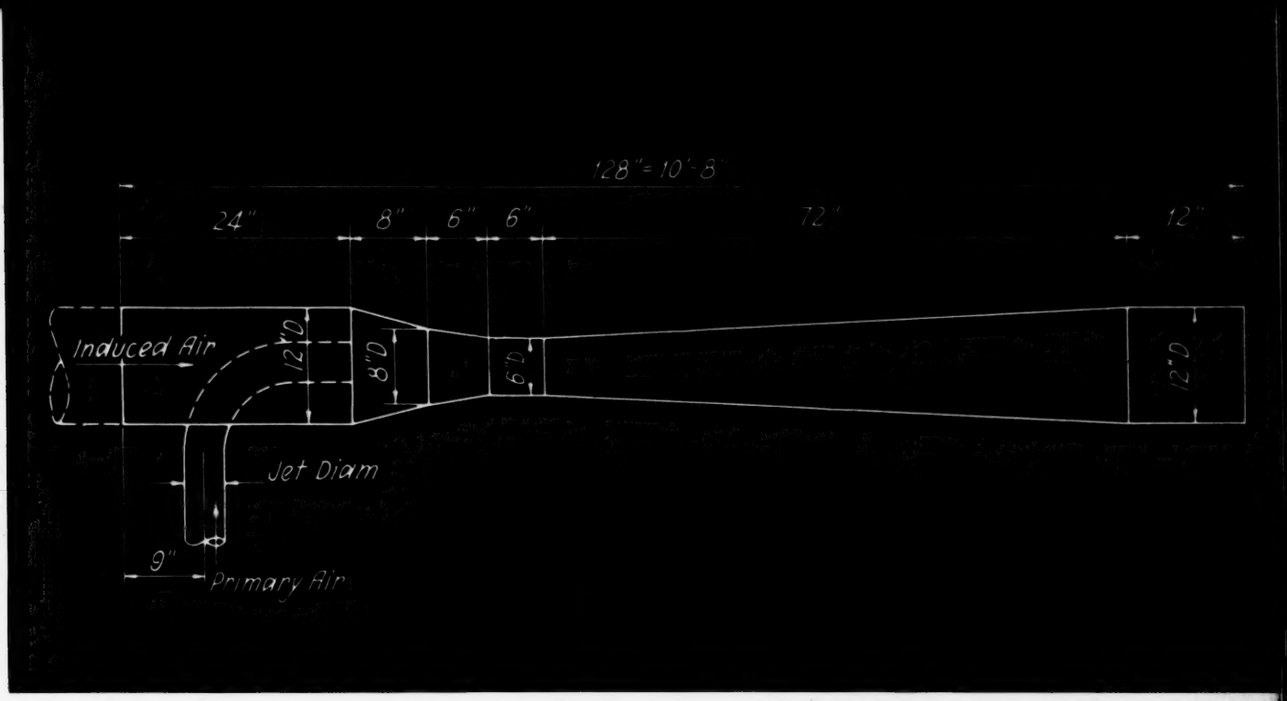
$$\text{Air H.P.} = \frac{\text{Volume of Air Flowing} \times \text{Total Pressure of Air}}{6356}$$

it is evident that any increase in volume for fixed mechanical resistance will result in an increase in horsepower. Since the horsepower curves are essentially a straight line function, the efficiency curves are not only straight but horizontal indicating an almost even efficiency over a wide range of airflow. It is interesting to note how closely together the horsepower and efficiency curves for the 2-in. and 4-in. diameter jets lie. Actually the curves almost coincided, but for purposes of clarity and explanation they were separated slightly. Both jets are far superior in performance to the 6-in. diameter jet. While the efficiency of the ejector using the 6-in. jet is only 2.5%, the smaller jets are approximately 12.5%, 5 times as efficient. It will be recalled that in the discussion of the curves shown in Figs. 6, 7 and 8 it was stated that the volumetric efficiency of the 2-in. diameter jet was 600% that of the 6-in. jet and as much as 250% of the 4-in. jet. This, however, was only the volumetric efficiency and took no account of the pressures which had to be developed in both induced and blowing ducts in order to cause this airflow. Comparing the 4-in. and 2-in. jets it can be readily seen that since the 4-in. jet is twice the diameter and hence, four times the area of the 2-in. jet, the corresponding velocities will vary inversely as this ratio, or will be four times as great for the 2-in. jet as for the 4-in. jet, provided, of course, the jet volumes are equal. Since the velocity pressure varies as the square of the velocity, the velocity pressure corresponding to the 2-in. jet will be 4×4, or 16, times the velocity pressure of the 4-in. jet. Since we are neglecting any jet resistance other than the loss at entrance to the mixing chamber of the ejector, plus the subsequent losses through the ejector up to and including final discharge, the velocity pressure can, for the moment, be considered as being identical with the total pressure (actually the total

10 **UNDER FREE DELIVERY CONDITIONS, the efficiencies of the 2- and 4-in. dia. jets are practically identical. It will be noted that these jets are far superior in performance to the 6-in. dia. jet, having an approximate efficiency of 12% as against the 2½% for the 6-in. jet.**

11 **WHEN THE EJECTOR OPERATES against the resistance A, all three jets are considerably more efficient. Under these conditions the efficiency of the 2-in. jet has risen to 24% as against the resistance of 20% for the 4-in. jet and 6% for the 6-in. jet.**

12 **THE LARGER RESISTANCE B caused the efficiency of the 2-in. jet to fall to approximately 18% and the 4-in. jet to fall to 14%. The reason for the decrease in efficiency is that the ejector is now operating to the left of the static pressure hump shown in Fig. 9.**



13 **A WELL DESIGNED EJECTOR of the shape illustrated should have a jet with a diameter of 1/6 to 1/3 of the ejector inlet diameter. The velocity to be maintained through the jet depends on the jet size and amount of air to be moved. It should be below 8000 ft. per min. for the larger jet while velocities up to 19,000 ft. per min. are suitable for the smaller jet. It is very important to keep the resistance of the discharge end as low as possible.**

pressure is less than the velocity pressure by the amount of the static pressure, which is negative, and, in any event, quite small). Hence, we see that for equal jet volumes, the 2-in. jet requires approximately 16 times the horsepower that the 4-in. jet requires. However, since 250% as much air is induced with the smaller jet, and since the induced air horsepower varies as the cube of the velocity flowing through the induction tube, the induced air horsepower corresponding to the smaller jet will be $(2.5)^3 = 15.7$ or almost 16 times the induced air horsepower when the 4-in. jet is used. Since it takes 16 times as much energy to do 16 times as much work, the efficiencies are almost the same.

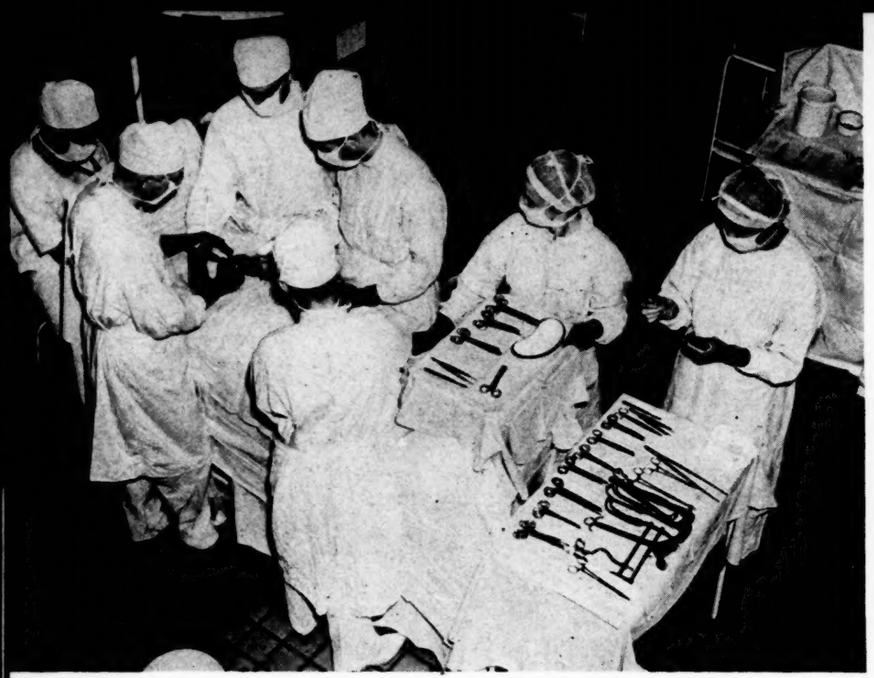
Fig. 11, illustrating similar curves for the ejector under induction resistance *A*, shows the effect of a certain amount of resistance on the induced air horsepower and efficiency. Both are greater than for conditions of free delivery. The efficiency with the 2-in. jet has risen to 24%, with the 4-in. jet to 20%, and with the 6-in. jet to almost 6%. Fig. 12 illustrates similar curves for induction resistance *B*, which imposes the greater mechanical resistance. As can be seen, while the efficiencies are better than for the condition of free delivery, they are not as high as for the previous curves. We are now operating to the left of the static pressure hump illustrated in Fig. 9 and previously explained.

The obvious conclusions to be drawn from these experiments as to recommended jet size is that where a venturi ejector of the shape illustrated in Fig. 2 is used a jet varying between 1/6 and 1/3 of the ejector inlet should be specified. If the job is a medium sized installation, use of the larger jet will necessitate a volume blower, which should not be costly and which would have the advantage of running at lower speeds, always desirable. If the installation is large, in order to avoid too costly blower equipment, the smaller jet and the pressure blower would be recommended. On many occasions the availability of existing blowers will determine the size jet to be used.

As to the proper velocities which should be maintained through the jet, it has been shown that up to a certain point, the output is proportional to the input. The point at which inefficient flow begins for the 2-in. jet was not reached in this experiment due to lack of sufficient blower capacity. Since the highest velocity reached in this experiment with this jet was approximately 19,000 ft. per min., it is extremely doubtful whether any practical installations will ever reach this figure, except of course, where a steam jet is used, and this, as will be explained later, is extremely inefficient. The 4-in. jet fell off in performance at a velocity of about 8000 ft. per min.

Effect of Resistance at Ejector Discharge

No curves were plotted for conditions of additional mechanical resistance at ejector discharge because it is desired to stress the fact that *this resistance must always be kept at an absolute minimum.* From the theory of the ejector, which will follow shortly, it will be seen that even a small amount of additional resistance, such as would only decrease the induced air by 25 to 40%, if applied at the induction or secondary end, is enough to destroy completely the effectiveness of the ejector if applied at the discharge end. Not only is no air induced, but some of the jet or primary air actually reverses direction and comes out the secondary end. Naturally, a certain amount of resistance is often necessary, such as might be represented by a length of pipe, perhaps an elbow, or a weather cap. In the case of the pipe, it should be made of as large a diameter as is feasible. The elbow should preferably be a long radius, multi-piece type, and the weather cap should be streamlined so as to avoid unnecessary shock losses. Where resistance cannot be avoided it will be necessary to increase the jet velocity.



Can the Hospital Afford Air Conditioning?†

By CHARLES F. NEERGARD‡

I MUST confess that as a result of considerable study of mechanical equipment as installed and operated in hospitals, I have looked on air conditioning with some skepticism.

My first introduction to man-made weather antedates the World War, when the plenum system, the grandfather of air conditioning today, was the hallmark of the modern hospital. I have seen probably more than a score of these installations costing at least a million dollars, none of which were being used. They were either too expensive to operate or didn't work. I have found but few hospitals with mechanical ventilation that regularly operated more than a small part of the system in which they had sunk their money. I suppose that in the past twenty years I have been in hospitals where there were literally miles of idle ducts and hundreds of horsepower in motors standing idle and rusting away.

Aside from certain groups (premature infants, studied by Yaglou, Drinker and Blackfan, hay fever and pollen asthma patients while remaining in air conditioned rooms) any clinical evidence that air conditioning is of value to the general run of hospital patients is not discoverable.

Some 250 hospitals have installed air conditioning, mostly limited to a few departments, but the experience reported deals chiefly with comfort. What therapeutic value has air conditioning for patients? Operating room conditioning has received the greatest attention and the prevailing opinion is that a temperature range from 78 to 82F with 55% relative humidity is the most desirable. Further study of operating room and particularly recovery room temperatures and other conditions most conducive to post-operative convalescence is clearly needed.

While it is far from an exact yardstick, because there are so many variables, the cost range of hospitals from $4,000 to $25,000 a bed is the most practical unit of comparison. Recent figures I have on the investment in power, heating and ventilating plants of ten hospitals, fairly comparable in size and requirements, designed by several different engineers, vary from $350 to $600 a bed without air conditioning. Few definite figures in air conditioning costs, depreciation and running expenses in hospitals are available. In two new hospitals under 150 beds, conditioning the essential sections was estimated to cost, $200 a bed in one and $433 in the other.

I took one of these ten hospitals with 120 beds and a total floor area of 63,000 square feet, of which 18,400 or 30% of the total would need air conditioning. This included patients' rooms and wards, operating and delivery suites, nurseries, laboratories, dining rooms, staff meeting and locker rooms, and entrance lobby. The installation cost at $1.13 per square foot would be $20,972, or $175 a bed over and above its regular plant cost of $350 a bed. Normal power, light and heat budget of this hospital will approximate $60 per bed a year. Using standard commercial building operating figures of 31 cents a square foot would add $8,832, or $66 per bed a year. Since offices are used not over ten hours a day and a hospital 24 hours a day, 365 days a year, the hospital operating cost would probably be double the commercial cost. It would seem conservative, therefore, that for complete air conditioning, the hospital's power plant investment will be increased at least 50% and its engineers' operating budget doubled.

It is elementary to suggest that the equipment required for hospital air conditioning should be designed on the basis of a performance specification calling for definite results in each section of the building, rather than one which dictates what type of system shall be used and how it must be installed.

Perhaps the most important consideration affecting air conditioning as a hospital investment is the question: "Will the hospital operate the equipment properly after they get it, and what will it add to the yearly

†Abstracted from an address presented before the Massachusetts chapter of the American Society of Heating & Ventilating Engineers.
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cost?" In my experience, the most important factor in a hospital mechanical plant is rational simplicity. Air conditioning is essentially precision apparatus. The engineer who designed the plant in one of our large New York institutions which pioneered in operating room conditioning wrote of it: "Temperature changes are maintained within one-half a degree and with some changes now in prospect, it is hoped to maintain relative humidity within less than one-half of one per cent."

Are such costly refinements necessary? Can any surgeon, nurse or anesthetized patient detect two or three degrees between 76 and 82, or can the most explosive anesthetic gas react to a variation of one per cent humidity? I visited this hospital one warm January day. The building was insufferably hot. In the operating room I found a piece of surgeon's plaster on the thermostat with the notation, "Maintain temperature at 76." The thermometer read 82F. I've often wondered whether the hospital's cost accounting system could determine what must be the terrific cost of overheating — one of the most common of hospital extravagances.

There is a wide divergence between theory and practice. The consulting engineer plans a thing one way; the plant engineer frequently does it another. As a practical remedy I have long advocated that the consulting engineer be given an annual retainer to see that his plant is properly run and serviced.

Only last month a hospital with a new vapor heating plant couldn't keep warm. The system required the maintenance of 29″ of vacuum. The plant engineer was a practical fellow who said that 12″ ought to be enough for any system and when they wanted more heat he just shot the steam through. We have found plants where engineers, tired of trying to keep thermostatic traps adjusted, had simply taken out the insides; and where even main line traps had been by-passed.

For years I have been using unit ventilators in operating and delivery rooms, specifying a single speed fan that insured ten air changes per hour, with no recirculation and a conveniently accessible filter. During a tour of six hospitals, where 24 fans of four differen. makes had been installed, I found only six units functioning satisfactorily. The correct type had been specified in every case and, where used, worked. But where the contractor had stepped in and substituted something "a little better," most of them didn't work because they were too complicated. They had variously, fresh air, recirculating and mixing dampers, manually controlled, three speed motors and inaccessible filters. In no instance were there found instructions for servicing. In one hospital, over a year old, the filters had never been cleaned. With so much trouble keeping the relatively simple equipment of today in proper working order, it is obvious that for successful air conditioning a new standard of operation and maintenance must be set up, or it will go the way of the plenum heating system.

As to the cost of operation of air conditioning, there is practically no accurate data from hospital experience. Some engineers say 50% more for cooling than heating; others 100%; but 50 or 100% more than what? Few realize the tremendous spread of engineering budgets in modern hospitals. Figures assembled for New York City of 23 large hospitals show an average cost for power, light and heat of $106 per bed and a spread of from $32.60 to $272.

To you gentlemen who design our mechanical plants in the hospital field, I beg that you make them just as simple as you can. We do not need more than normal heat except in a few rooms. We cannot afford elaborate air conditioning. I cannot conceive, in the light of present financial conditions, that many hospitals can hope to adopt general air conditioning. All that we can afford are well designed units in certain sections. The general acceptance of air conditioning must await more factual data as to its therapeutic value and more practicable cost levels.

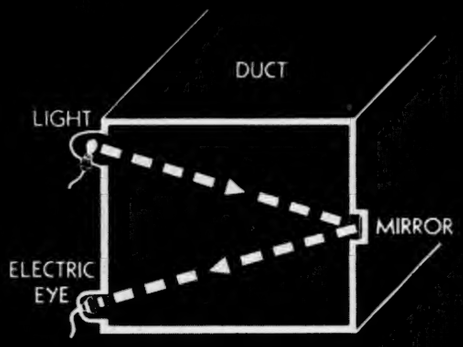
Oil Fired Boilers Heat Florida Aquarium

Devil fish, sharks, rays, the only porpoises in captivity, and thousands of other unusual specimens find their adopted home in the Marine Studios at Marineland, Florida. There, in huge tanks liberally perforated with glass portholes to facilitate study and photography, the many specimens live together. Unlike that at ordinary aquariums, at the Marine Studios marine life is not segregated by species but is placed together much as it exists in its native waters. To afford protection for the smaller fish and also to provide atmosphere for photography, many natural "props" are present—a coral reef, a rock ledge, the remains of a shipwreck.

But the tropical fish require water to be not only filtered and serated (as all Marine Studios water is) but also held at a temperature of approximately 70 degrees—considerably higher than the year 'round temperature of the natural water supply at Marineland. Learning of the heating problem that was involved, the Southern Air Conditioning Corporation, G-E distributor in Jacksonville, submitted plans for the installation of five big oil-fired boilers, each with maximum rating of 450,000 B.t.u. per hr. The proposition met all requirements, and shortly afterward the 500,000-gallon "tropical" tank was being held at a temperature just like home for the transplanted equatorial specimens.

Heat exchange is in the filter banks, housed outside the studio. Two thousand gallons per minute—some recirculated and some sea water—pass through these banks and are heated in the process. Operation of the furnace is regulated by thermostats in the pipeline that runs from the heat exchange banks to the large fish tanks.

Marine Studios directors state that, particularly in view of last winter's coldest weather in Florida history, without the boilers many valuable tropical specimens would have died.



OWING to the fact that the Ernst Kern Company, one of the large department stores in Detroit, had recently suffered from a low heat fire, the desire of the management to avoid a repetition of such an occurrence, and to cooperate with their insurance companies, led them to take the initiative and to participate in the work of development of a protective system. To assist them in the work they called upon the author's firm to act in a consulting and advisory capacity.

The installation here described was completed last spring, and is believed to be the first system of its kind to be put into operation.

Fire Hazard

For some time past, the question of the fire hazard involved in the operation of ventilating and of air conditioning systems has been under consideration by the insurance organizations, municipal building and safety engineering departments and bureaus and others whose function is concerned with the elements of financial risk, or the safeguarding of the individual, of the property involved, of the adjoining premises or of the community as a whole.

The problem involved is compound rather than simple, in that it can be resolved into several elements, viz., (a) the transmission of flame, heat or smoke from an outside source through the path afforded by the duct system; (b) the distribution through the building of the products of combustion resulting from a fire originating within the duct system due to foreign matter deposited therein; and (c) the hazard involved by the combustible nature of certain parts of the apparatus, itself.

Superficially, the first and the last of these elements are the most obvious and, for some time past, these items have been given considerable attention.

In connection with installations for the air conditioning of mercantile establishments, especially of department stores, it was found, upon investigation that large deposits of refuse—scrap paper, chewing gum wrappers, cigar stubs, cigarette butts and other detritus —deliberately inserted through the grilles by "certain lewd fellows of the baser sort" (to use the words of the Apostle) accumulated in the openings. This, especially due to the well-known fire-retaining characteristics of the cigarette butts, created an additional, very real, hazard, to overcome which various schemes have been resorted to, principally in the nature of suitable screens at the openings. The principal objection to the use of screens is that, if they are of sufficiently fine mesh to accomplish the desired purpose, they add a very appreciable additional resistance to the air flow.

This but serves to emphasize the fact that, in the case of new developments, as experience is gained and as familiarity with the problem increases, ideas as to the fundamentals change and the ultimate viewpoint may be quite different from the original conception.

A number of fires occurred, within a short period, all of which were within some part of a duct system. This, in itself, was no cause for alarm, but the disturbing feature of each was that in no case was enough heat generated to either cause the failure of a fusible link or to release a sprinkler head, while the amount of smoke given off due to incomplete combustion was out of all proportion to the actual amount of combustible material involved and the total damage resulting ran into the hundreds of thousands. These fires were in mercantile establishments and that no panic resulted with the probable attendant loss of life was due to the fact that the most serious one occurred *after hours* when the store was empty save for a limited number of employees who had been taking inventory.

These occurrences forcibly demonstrated the need for constant vigilance and foresight enough to *keep one jump ahead* of the actual need for protection. It was evident to the most superficial consideration that some new and effective means of protection must be devised to prevent the damage from smoke as well as from heat.

The problem presented itself in two-fold form; first, that the public, having become *air conditioning minded,* so to speak, preferred to do their trading in air conditioned establishments; second, that if establishments were to be air conditioned, unless the possibility—if not probability—of increased insurance premiums was to be faced, some additional safeguards must be devised and, furthermore, unless the merchant were to be unduly penalized, these devices must be such as not to be prohibitive in cost.

Smoke Detecting System

The schemes offered for consideration were based upon an adaptation of the use of the photo-electric cell, or electric eye, as it is popularly called.

The installation, as made, was as an extension of the A.D.T. system already in place in connection with the automatic sprinkler system, thus putting the entire fire protection alarm system *under one roof* and the responsibility for the supervisory service entirely in the hands of a single organization.

It was decided by the insurance authorities, early in

†Office of Smith, Hinchman & Grylls, Inc., architects and engineers, Detroit.

the proceedings, that in the case of a ventilating system taking air for recirculation out of a single space unit to which the air was delivered by the fan (i.e., where the system served a single story or only some portion thereof), there would not be, generally speaking, the same necessity for the installation of smoke detection devices, since any smoke originating in the space served by the system would be immediately perceptible therein and would not be distributed outside the area where it originated. This rule, however, is subject to exception depending upon local conditions. Conversely, it was decided that where a fan served several stories or parts thereof so divided that, were smoke to originate in one of the parts, it would not normally be rapidly carried to other parts *unless the fan was in operation,* such protective equipment was necessary for protection against smoke damage.

The apparatus in the Kern Company's store affected by this decision consisted of three units. These units, which, for convenience, will be called A, B and C, are located in the sub-basement.

Unit A serves the transformer room and a portion of the sub-basement, while units B and C serve their respective portions of the basement, first floor and mezzanine.

Equipment

The following description of the apparatus will be confined to unit C, which is typical of the type of protection installed.

In order to secure the protection desired, it was necessary to accomplish several things, viz.:

(a) To detect the presence of an appreciable amount of smoke in the air handled by the fan.

(b) When the smoke in the air passing through the fan reached a pre-determined density, to shut down the apparatus and—

(c) Coincidentally, to cut off the air supply to the fan by means of an automatic damper on the inlet side of the fan, at the same time closing off, by auxiliary dampers, such return air ducts as entered the intake chamber. Note that no attempt was made to close the fresh air inlet which was left open to act as a *blow back,* or vent.

(d) To actuate an alarm both on the premises and, through the existing system, to the supervisory station.

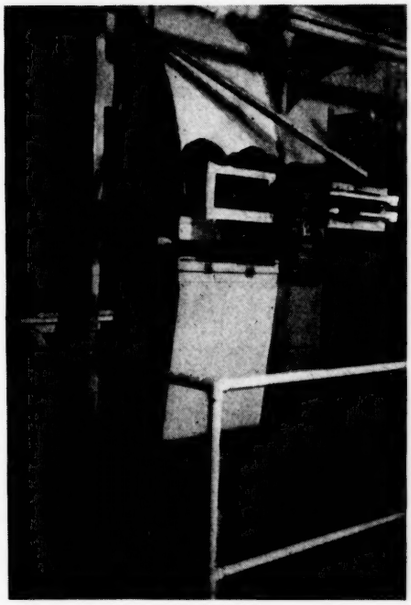
These results were obtained in the following manner:

A photo-electric cell was installed adjacent to the fan discharge duct and an electric lamp of suitable light flux characteristics installed adjacent to the photo-electric cell on the same side of the duct. On the opposite side of the duct, on a line midway between the photo-electric cell and the lamp, was placed a suitable mirror, the combination being so arranged that light from the lamp would be reflected by the mirror into the photo-electric cell, thus giving two light paths across the duct. The entire apparatus is installed outside the duct and entirely independent of it, on rigid angle iron supports fastened to the building construction above. Windows are provided in the duct, through which the light passes.

In order to prevent dust from the room being deposited on the apparatus, the photo-electric cell, lamp and mirror are encased and connected to the duct windows by flexible, light-proof fabric sleeves.

The reduction in the current from the photo-electric cell, induced by change in light density, operates a relay which, in turn, energizes an electro-pneumatic switch operating the shut-off dampers and, by electrical interlock, trips the fan motor starter and shuts down the apparatus.

At the same time, the local and the remote (super-



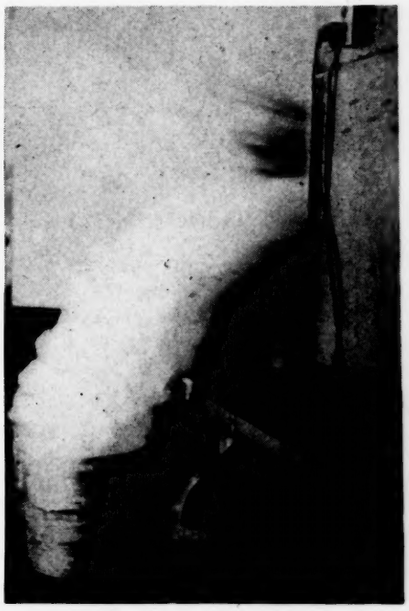


Fig. 2 (left). Method of support of light source and photo electric cell attached to apparatus A. These units are housed in. Mirror is similarly housed on opposite side of duct. Fig. 3 (center). Closeup of housing of light source and photo electric cell. Same as Fig. 2 but closer view. Fig. 4 (right). Smoke demonstration at inlet chamber of fan of apparatus C. Smoke is being admitted from smoke bombs in pails. Smoke is greatly in excess of minimum required in order to make apparatus act quickly during demonstration.

visory) alarm circuits are energized and the alarm signals given.

These alarm signals and relays are so arranged and interconnected with the existing fire-protection system alarms that the release of a sprinkler head or the *pulling* of any of the fire alarm boxes on the premises will sound the alarms and also by energizing the relay shut down the fan apparatus (all three units) and close the dampers in the same manner as though actuated by the photo-electric cell.

Light Failure

It is pertinent, although perhaps hardly necessary, to say that in the case of failure of the actuating light source, by burn-out or otherwise, the circuits are so compensated that the apparatus will continue to run, but both the local and the remote (supervisory) alarms will be sounded, calling attention to the trouble, since actuation of the protective apparatus is dependent only upon the decrease beyond the pre-determined point of light intensity upon the photo-electric cell, irrespective of the cause of the light diminution.

The question naturally arises, "What is the minimum percentage of smoke to which the apparatus will respond?" To this the answer must be in indirect form, since the effect is due to the *cloudiness* only and the color or, if you prefer, the intrinsic opacity of the smoke is the determining factor. Then, too, it is to be remembered that the time rate of light change, also, affects the sensitivity of the cell and that the more rapid the decrease of light intensity the more rapid the action of the apparatus.

As a matter of fact, it was found that if the apparatus was adjusted to respond to a minimum change in light intensity of eighteen per cent, the action was satisfactory. In determining the setting, calibrated, translucent screens of various opacities were used, much on the principle of the wedge photometer.

Operating Results

Although the installation is successful and operated in an entirely satisfactory manner, it is reasonably safe to say that there is room for considerable improvement and to predict that, as the number of installations increases, the apparatus will be improved and simplified and that the cost of such a system will be decreased.

As has been previously mentioned, there were certain alterations in the existing system necessary to adapt it to the requirements, and the cost of the installation was materially increased thereby. In the case of a new system, the apparatus could be provided for in the original design with the result that the cost would be considerably lowered.

In connection with the installation there is one feature of especial interest, viz., the relief dampers which are installed between the shut-off dampers in the intake chamber and the fan inlet.

It was originally intended to use a *vortex damper* in the fan inlet to close off the inlet chamber from the fan, but from the data on such dampers presented for review, it was decided that, owing to the shape of the blades, such a damper would not be sufficiently smoke-tight to conform to the insurance requirements. For this reason a sheet metal partition was built across the intake chamber, about thirty inches from the fan inlet, *between all recirculating duct openings and the fan,* and in this partition was installed a pneumatic motor operated louver damper, so constructed that the leakage through the damper with the blades closed would be reduced to the minimum.

The function of this damper is to close quickly and completely, say in not over ten seconds from the actuation of the relay. (It actually closes in about three seconds.)

When this damper closes, the fan, although the power is cut off, is still running at a relatively high speed. It follows, then, that upon the closing of the inlet damper, there will be a lowering of internal pressure on the walls of the inlet chamber between the damper and the fan, as well as upon the damper and its supporting partition—and that this condition will be imposed upon the surfaces quite suddenly.

Function of Relief Dampers

It is the function of the relief dampers to open when the intake damper closes and, by admission of air from the room, to equalize the pressure inside the portion of the intake chamber between the inlet damper and the fan and so to prevent any tendency of the surfaces to buckle or collapse.

These relief dampers are simply specially constructed louver dampers of about one-third the area (total) of the inlet damper. For convenience, two of them were installed, one on each side of the intake chamber. They are automatic in action and are very similar to the familiar aluminum back-draft damper, or balanced damper, but constructed with steel frame and steel blades. In fact, such aluminum dampers were first tried, but it was found that the blades were not sufficiently rigid to withstand the external pressure.

The relief dampers are held normally closed by a counter weight which is attached to the damper rod by means of a cord running over a freely turning pulley. This counterweight is so proportioned that the damper is held closed against normal fan suction but opens when the inlet damper closes and the differential pressure exceeds the normal.

Filters

It is apparent that not only smoke but dust or any other opaque substance in the air stream will, if in sufficient quantity, cause the apparatus to function. For that reason, it is desirable to use a filter to remove the dust from the air in connection with such equipment. This has been clearly demonstrated by the Kern Company's installation. There are filters in connection with apparatus B and C, but not with apparatus A. Upon occasion, the handling of the dust cloths, customarily laid over open stock displays at closing time, has introduced enough opaque matter into the air stream to cause the protective apparatus of the latter unit to function.

TOURIST COURTS TURN TO CENTRAL HEATING AND AIR CONDITIONING

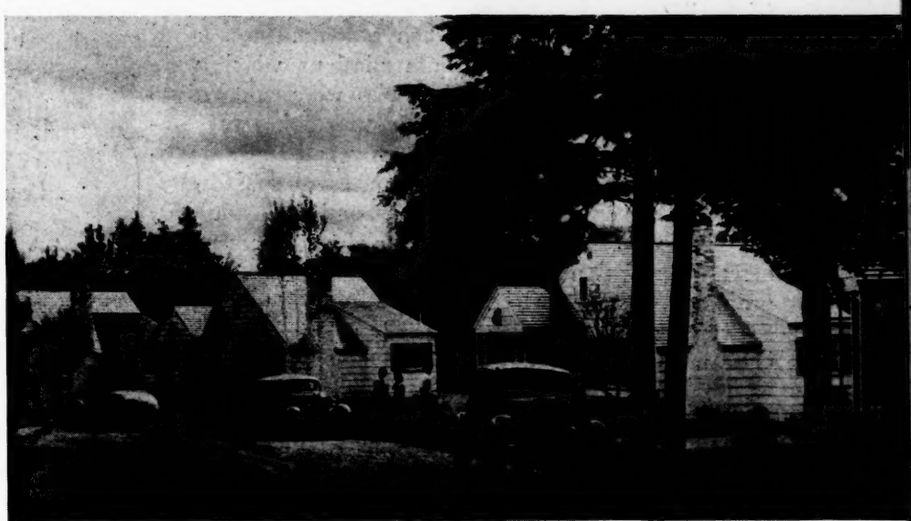
The tourist court industry came into being as a result of the depression and the need for low cost convenient accommodations for auto travelers. At first only the barest necessities were provided — a single room, central bathrooms and no heat. With increasing business and more competition came the deluxe tourist court which offered facilities frequently superior to those provided by other establishments catering to travelers.

Within recent years many of these courts have turned to central heating and air conditioning. This trend has considerably affected the layout and architecture of tourist courts. If economical operation is to be secured no longer may the inns consist of individual cabins spread out over a large area. In fact, there are some indications that the requirements of central heating and air conditioning may cause the tourist court to become a little more than a roadside hotel in design.

Out in the western part of Texas for example, one tourist court has abandoned the horseshoe type of construction and has eliminated the attached garages with the result that it appears to be more of a modern roadside hotel than a tourist court.

On this page are four examples of modern tourist inns.

1 **SANTA ANITA MOTOR INN on highway U. S. 66 in Arcadia, California has a very desirable compactness in design which makes air conditioning a relatively easy and economical matter. This green structure of cement and plaster is located in a picturesque setting in the shadow of the San Gabriel Mountains and just across the road from the famous Santa Anita race track. Fifteen modern suites are available for rental at moderate price.**



2 **RADICALLY DIFFERENT from the early tourist camp is the Lakewood Tourist Court in Skowhegan, Maine, yet it embodies the principle known to resort centers of having individual cabins. Night air cooling could be applied to a gable-roof structure such as this, particularly in courts where there are several rooms per cabin to cover the expenditure for fan cooling.**

3 **USUAL IN TOURIST COURT DESIGN, but new in every respect, is Court San Rafael on the Redwood highway out of San Francisco, Calif. This type of court is more adaptable to single unit cooling than to central air conditioning.**

4 **AIR CONDITIONED DeLuxe Court is located right on the highway at Seymour in Western Texas. The demands of air conditioning have done much to influence the design of this apartment court. There are 13 units in this building.**

New Smoke Ordinance in St. Louis Aids Mechanical Fuel Burning Equipment

ST. LOUIS has long had a smoke problem. Much of the fuel used in the city for heating purposes is bituminous coal of the high volatile variety. It is not unheard of for the heating coal in St. Louis to show a volatile content of well over 30%, and sometimes approaching 40%, on analysis.

The problem is of long standing and has been a source of frequent agitation on the part of public bodies. As early as 1929 the Citizens Smoke Abatement League estimated that smoke was costing St. Louis citizens nearly $20,000,000 each year. Attempts to help the situation have taken the form of ordinances and various smoke commissioners have held office from time to time charged with the responsibility of seeing that the ordinances are enforced.

Most recent of these attempts have been some five or six years in the process of development. It may be said to date back to 1934 when a committee studied the problem, prepared recommendations which were promptly blocked by interests who were opposed to them. A professional consultant on smoke was employed by the city to make a survey and suggest possible solutions. In 1937 an ordinance was passed containing the expert's suggestions and, in addition, containing the so-called *washing clause*. A recent renewal of agitation resulted in amendments to the 1937 ordinance.

Prominent among these amendments were suggestions made by the Associated Engineering Societies of St. Louis, which amendments were passed and became effective early in April 1940. The new ordinance is believed to be at least as drastic, if not more drastic, than any ordinance on the same subject in any other American city.

Use of a solid fuel containing more than 23% volatile matter on a dry basis and for hand firing is prohibited. Provisions are also written into the ordinance aimed at restricting the emission of fly ash and also making railroads entering into St. Louis subject to the terms of the ordinance. Stiff penalties are provided in that fines of from $25 to $100 may be imposed for each day on which violations are recorded. The Division of Smoke Regulation of the city employs a staff of inspectors each assigned to a part of the city and charged with the duty of observing and recording violations and working with violators to attempt to abate the cause of the trouble.

One of the effects of the ordinance has been to focus attention on the availability of solid fuels which contain less than 23% volatile. Those commonly available in St. Louis include coke, processed soft coals, and soft coals from certain parts of Arkansas and Oklahoma. The ordinary grade of Illinois coal which commonly finds its way to the St. Louis market does not meet the 23% volatile requirement unless processed in some way.

It is of special interest to note that under the requirements of the new ordinance any fuel is considered as suitable for use inside the city provided it is burned in mechanical equipment since the 23% volatile content requirement applies only to hand-firing. This means that any grade of coal is considered suitable provided it is burned on a mechanical stoker, that oil burners and gas burners will also meet the requirements of the ordinance.

With the ordinance in effect and with public interest in the movement to abate the smoke nuisance running high, naturally dealers in fuel burning equipment have been quick to call attention to the value of their equipment in meeting the terms of the ordinance.

One means of doing this has been the organization of the "St. Louis Clean Air Exposition." This consists of a show and display of equipment in quarters located at Fourth and Washington Streets, open to the public from 11 a.m. to 10 p.m. during the entire period from May 18 to June 29, adopting as its slogan "Help Make St. Louis A Smokeless City." The Exposition aims to give all citizens of St. Louis an opportunity to see the kind of equipment which is readily available to them in meeting the requirements of the smoke ordinance.

A large number of interested St. Louis groups are promoting this Exposition. They include (1) The St. Louis Stoker Association with J. H. Hanson, president and George A. Hale, executive secretary; (2) The Approved Oil Burner Association, with Glenn Hill, president; (3) Laclede Gas Light Company; (4) Various individual coal dealers; (5) Processers of Illinois coal, notably Solonite and Carbonite; (6) Arkansas-Oklahoma Smokeless Fuel Association; (7) Division of Smoke Regulation, Department of Public Safety of the City of St. Louis.

The Exposition includes some 45 booths where coal stokers, oil burners, gas equipment, and various fuels are on display. The great majority of the exhibitors have provided an attendant to be present at the booth during the entire period.

Another activity on the part of equipment dealers has been the increased selling campaigns directed at those affected by the new ordinance. These activities have been evidenced not only by greater activities through the usual selling practices but through advertisements appearing in the St. Louis papers asking for stoker salesmen and display advertisements by stoker dealers especially. Recent advertisements in St. Louis newspapers have featured household stokers with installed prices in the neighborhood of $170 to $180 including controls.

A Rapid Method of Estimating Heat Loss

By ALFORD G. CANAR

Here is a short cut method of estimating the heat loss of buildings or individual rooms. The method is so simple that even untrained men should be able to secure estimates in about ten minutes which are within 5% of the results obtained by longer engineering estimates. This method was developed by the engineers of a large utility.

DETERMINATION of a heat loss is the basic step involved in any problem of heating because the heat requirements of any building, room or space to be heated must be known before any other figuring or calculations for heating equipment can be made.

The determination of a heat loss in the engineering manner involves considerable measuring and figuring. Measurements are taken to determine cubical contents, all windows and doors are measured for size, exposed walls must be measured, roof and floor areas measured, construction examined as regards types of walls and thickness, roof construction, floor construction, insulation in walls, ceilings or roofs, air infiltration must be estimated. Such a procedure involves time and after all these measurements and determinations have been made, a series of calculations must be made to determine air change loss, window and door loss, exposed wall loss, roof loss and floor loss. All in all for an average small residence, for example, a whole hour of time is required to actually determine the heat loss. On larger buildings the time element involved is proportionately increased.

Need

Such a procedure is well worth while where new installations or a change of system is concerned because the more engineering put into the job the better the job. However, no matter how carefully a heat loss may be calculated from measurements, conductivity factors and estimates of intangibles based on the judgment of the engineer while making his survey of the building, the heat loss still is not entirely accurate and

TABLE 1.—SHORT METHOD OF ESTIMATING HEAT LOSS

Type of Building	Multiply* Cubic Contents By
Residences (heated to 70F)	
1. For entire building. (See note 1)	
No insulation	6.5
With roof insulation only	6.0
With roof and wall insulation	5.5
2. For first floor rooms with heated space above. (See note 2)	
No insulation in walls:	
No storm windows	5.8
All storm windows	5.5
Insulation in walls:	
No storm windows	5.5
All storm windows	5.1
Sun rooms and other rooms having an unusually large number of single windows and at least 2 exposed walls	10.0
Sun rooms and other rooms having an unusually large number of windows, all storm windows, and at least 2 exposed walls	7.0
3. For upper floor rooms or bungalow rooms. (See note 2)	
With flat roof:	
Single windows, no insulation in ceiling	7.3
All storm windows, no insulation in ceiling	7.0
Single windows, insulation in ceiling	6.5
All storm windows, insulation in ceiling	6.2
With eaved roof:	
Attic space above, single windows, no insulation in ceiling	6.8
Attic space above, all storm windows, no insulation in ceiling	6.5
Attic space above, single windows, insulation in ceiling	6.0
Attic space above, all storm windows, insulation in ceiling	5.7

Type of Building	Multiply* Cubic Contents By
Stores (heated to 70F). (See note 1)	
All walls exposed:	
Flat roof	6.9
Heated space above	5.2
Warm party walls on both long sides:	
Flat roof	5.8
Heated space above	4.1
One long side wall warm party wall:	
Flat roof	6.3
Heated space above	4.7
Public garages (heated to 60F)	
All walls exposed:	
Skylight in roof	5.5
No skylight in roof	5.1
Heated space above	4.0
Warm party walls on both long sides:	
Skylight in roof	4.7
No skylight in roof	4.4
Heated space above	3.0
One long warm party wall:	
Skylight in roof	5.0
No skylight in roof	4.9
Heated space above	3.4
Factories or warehouses, all walls exposed. (Heated to 65F):	
Skylight in roof, one story	5.8
No skylight in roof, one story	5.3
No skylight in roof:	
Two story	4.3
Three story	4.0
Four story	3.8
Five story	3.6
Six story	3.4

NOTE 1.—If the building has bad north and west exposures, increase the heat loss by 10%.

2.—If the room has bad north and west exposures, increase the heat loss by 20%.

*Figures are in all cases B.t.u. of heat loss per hour per cu. ft. of contents. The factors apply only to a 0-70 degree design temperature, building temperature at 70 and minimum outdoor temperature of 0 degrees.

therefore is only an approximation. Infiltration and other air change is only an estimate at the best and often only a guess tempered by the judgment of the engineer. One 12 inch brick wall may conduct heat faster than another 12 inch brick wall because of different brick, different mortar and deterioration of brick and mortar allowing air leakage which was not taken into consideration on infiltration or air change and at the same time increases the heat conducting surface of the outer brick wall surface which has its corresponding effect on the inner wall surface. And since heat conductivity factors were determined in a laboratory for definite construction features and the latter are only approximated in the field, it should be apparent to anyone that no matter how carefully we measure and calculate, the resulting heat loss figure is only an approximation at the best. However, since our best methods have their limitations we must get along as best we can with them.

Use by Service Men

After the heating system is installed it often happens that some difficulty arises about heating some room or section of the building and sometimes the entire building. The man who answers a complaint from such a difficulty is often not an engineer but a serviceman who usually is not technically trained. He may want to know whether some room, some section of a building or perhaps the entire building is properly radiated, because if the central heating plant operation seems to be just as it should be, still the heating of the space is not as it should be.

The serviceman should not be expected to check the radiation by the method used by the engineer because it is too time consuming and laborious. He should have a quick method of checking so that he can readily arrive at a reasonably approximate heat loss from which he can readily determine shortage of radiation. He should have a method of figuring a heat loss which won't consume more than about five to ten minutes of his time and still be reasonably accurate. Such a method must call for a minimum of measurement and a minimum of calculation.

Development

Years ago the need of such a method for quick checking of faulty installations was realized. Gradually a method has been developed based on the cubical contents and certain factors. Over a period of years other factors were developed and the method checked against the engineer's method of figuring heat loss. The method as it now stands will apply to any room, space or building and will give a heat loss calculation which will check generally within five per cent of that of the engineer's method and consume only about one-tenth the time involved as compared with the latter.

It is not intended to replace the engineer's method but merely to be used for rapid checking and it has sufficient accuracy to be worth while in this respect.

It requires taking just a few measurements in order to be able to calculate the cubical contents of the room, space or building, making a rapid survey or asking the occupant a few questions, then consult the prepared tables for the situation at hand, pick out the proper factor and multiply it by the cubical contents and the heat loss is obtained. For an average residence less than ten minutes will cover the entire procedure.

TABLE 2.—MULTIPLYING FACTORS

Minimum Design Temperature	Correction Factor
+ 50 degrees	0.29
+ 40	0.43
+ 30	0.57
+ 20	0.72
+ 10	0.86
0	1.00
— 10	1.14
— 20	1.28
— 30	1.43

The factors, which are the heat loss in B.t.u. per cubic foot of contents of room, space or building, are arranged in tables for residential buildings, stores, garages and factories or warehouses. Maintained temperatures considered desirable for these buildings are 70, 70, 60, and 65, respectively, which are taken care of in the factors.

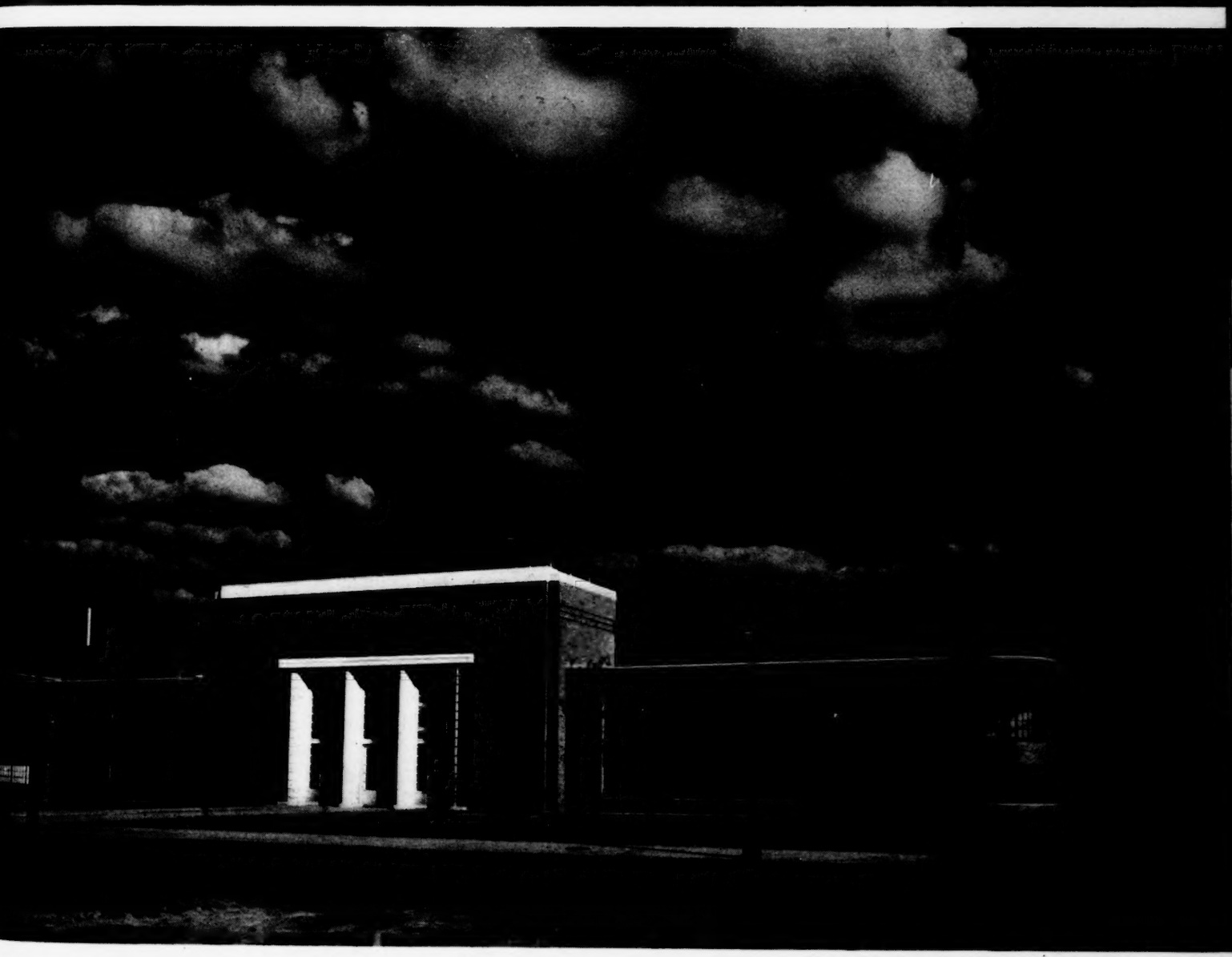
Outline of Method

In brief the procedure is as follows:

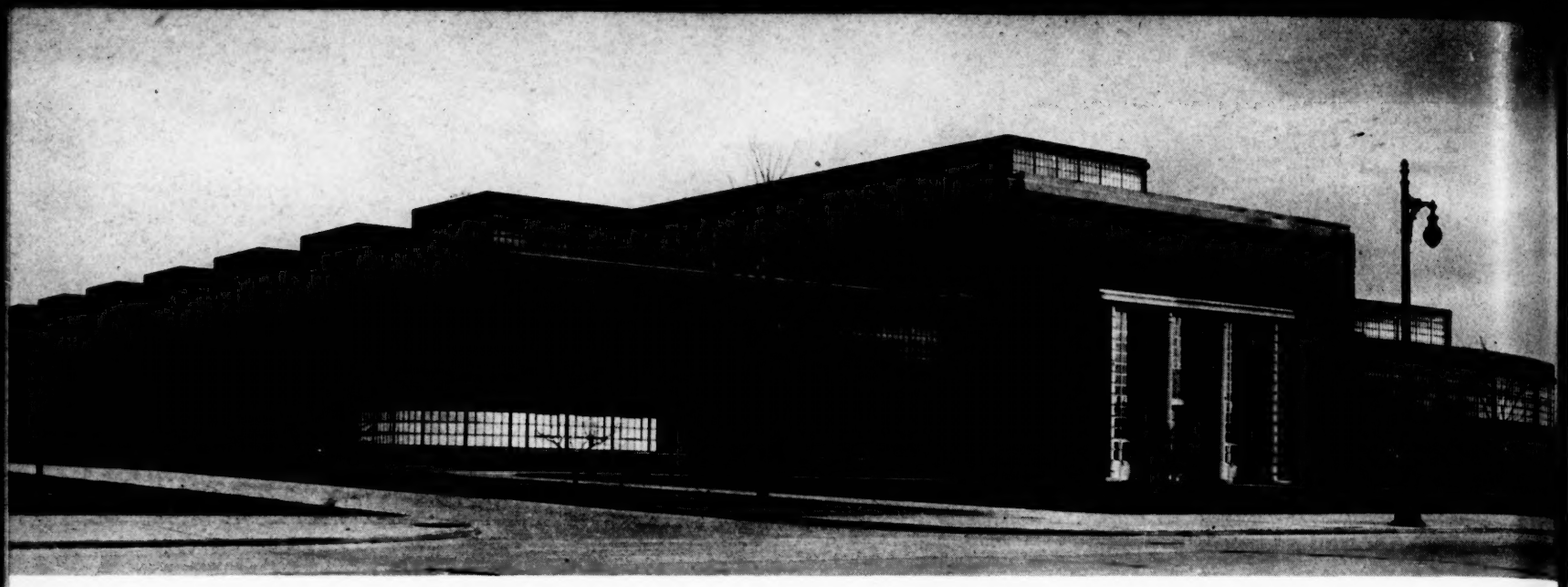
1. Measure length, width and ceiling height, taking account of any shape of floor area other than one simple square or rectangle. Calculate floor area and multiply by ceiling height to obtain cubical contents.
2. Make a rapid scouting survey to observe what the prevailing conditions are so that the proper factor may be selected. See whether there are any party walls, heated space above, flat or eaved roof, storm windows, or skylights.
3. Select proper factor from Table 1 and Table 2.
4. Multiply cubical contents by the factor from Table 1 (and from Table 2 where necessary) and thus obtain the heat loss in B.t.u. per hour.

For conditions in parts of the country where design temperature differentials other than 0° and 70° are customary the factors from Table 2 are applicable by multiplying the heat loss obtained by using the heat factors in Table 1.

In the foregoing procedure it is very evident that a few simple measurements, a few minutes of intelligent survey and a few minutes of simple multiplication are all that are required to obtain a heat loss which is sufficiently accurate for checking purposes. Any serviceman today, who has intelligence enough to be a serviceman, certainly will have no difficulty in using this method. Since a serviceman can thus readily check radiation, pipe and duct sizes, boiler and furnace sizes, etc., the expense of sending an engineer to the job is saved. Not only that but the engineer himself can use it for quick checking.



A SECTION OF "HEATING & VENTILATING" SHOWING
INDUSTRIAL PLANTS PROMOTE PROCESSES AND
BY SCIENTIFIC CONTROL OF ATMOSPHERIC



Ford Motor Company

Tool and Die Shop is kept free from abrasive dusts from grinding machines and dangerous fumes from heat-treating furnaces by exhaust systems which, due to ingenious engineering, are practically invisible.

By CLIFFORD STROCK†

ONE way of arranging abrasive exhaust ducts from 191 grinding machines would be to run the individual branches to a main overhead and the main to the roof.

One way to arrange the fume exhaust ducts from 44 heat treating furnaces would be to have a network of pipes overhead connected to each furnace and running directly to the roof.

Both of these arrangements would be practical and both would work; they have worked before. But whatever would be the advantages of such a design, among them would certainly not be included that of appearance. In fact, the sight of 235 individual ducts rising directly from machines and furnaces would be appallingly bad, to say nothing of the obstruction of light.

This problem of laying out an exhaust system for 235 pieces of equipment has been solved in the Ford Tool and Die Shop by an installation that represents a strikingly smart and clean job of engineering.

The Ford Tool and Die Shop is a 300 x 1225 ft. structure at the Rouge plant, near Detroit. This building, with 15½ million cubic feet of heated space, is the largest in the world used entirely for tool and die work, contains 1400 machines and has a working personnel of 2800 men. The building is heated by 18 suspended type units, mounted overhead, and equipped with filters to clean the air.[1]

Two sections of the building require additional air treatment. In the section accommodating grinding machines the metal and abrasive particles from each machine are exhausted through hoods close to the work being ground, thence through ducts to dust collectors on the roof. In the heat treating, or hardening room, the fumes from the numerous furnaces are exhausted through ducts to the outside to prevent air contamination.

Dust Exhaust

A notable point about the exhaust system serving the grinding department is the practically complete absence of visible ductwork. There are no exhaust ducts running from the hood to branches above the groups of machines to cut down light and visibility in the plant. Instead, from the hood of the machine the exhaust connection-drops to the floor, then is run under

†Associate Editor, HEATING & VENTILATING.

[1]The heating and air conditioning of this building was described in the November, 1939, issue of HEATING & VENTILATING.

Fig. 1. The Ford Tool and Die Shop of the Rouge Plant, Dearborn, Mich., which has underground dust exhaust mains serving the grinding department and a fume exhaust system which removes dangerous and unpleasant fumes from the heat treating furnaces in the hardening room. The clean and trim appearance of both of these departments can be largely credited to the nicety of exhaust system design which resulted in unobtrusive ductwork. Both of these systems are described in this article.

THIS INSTALLATION

NO. 19 OF A SERIES

Owner — Ford Motor Co.

Location — Rouge Plant, Dearborn, Mich.

Architects and Engineers — Giffels & Vallet, Inc., Detroit, under the direction of H. B. Hanson, Power & Construction Dept., Ford Motor Company.

the floor to a main located under the aisle, and thence under the floor to a rectangular riser located along the side wall of the building. Since the risers are relatively flat and located along the wall they are practically unnoticed; as for the connections to the exhaust hood, these are usually small and, consequently, they are quite unobtrusive.

Each of the connections to the exhaust hood is so designed, where necessary, as to allow the hood to follow the path of the grinding wheel in cases where the grinding wheel has a motion other than its own revolution. This is allowed for by swing joints packed with heavy grease to make them airtight, as shown in Fig. 3.

The plan in Fig. 4 shows the general arrangement of the branches and main in a typical aisle.

The method of concealing the branches and main under the floor is shown in Fig. 5. Branches from each individual machine are completely concealed and covered by wood blocks, as shown to the right of Fig. 5, so that they are not accessible. These branches are made of ⅛ in. plate laid in the concrete, with a welded plate closing the top. The mains, however, are made of 3/16 in. plate bent to form three sides of the duct and with the top formed of ⅜ in. checkered plate welded to the sides of the duct. At intervals the plate is not welded but laid in place so as to be removable and provide access to the ductwork.

One problem nicely solved in the under-floor duct system was that of clean-out doors. These were necessary for access and cleaning as the rather shallow, wide duct is quite susceptible to clogging, the air stream naturally flowing toward the center of the duct and dropping some of its burden along the outer edges. Also the clean-outs, being in a traffic aisle, had to be flush and water-tight as the floors are washed daily.

Connections to the machines presented some difficulties, as practically all machine manufacturers provided hoods and connections of the usual updraft design; therefore major alterations, and in some cases entirely new hoods, had to be made.

Dust Collectors

On the roof are 15 banks of dust collector units, illustrated in Figs. 7 and 9, and consisting of 92 collectors handling 92,000 c.f.m., each bank serving an aisle. Dust-laden air from the risers is distributed by a main to the individual units making up the bank of dust collectors, entering each collector at the bottom. Each collector unit consists of a cylindrical housing, a

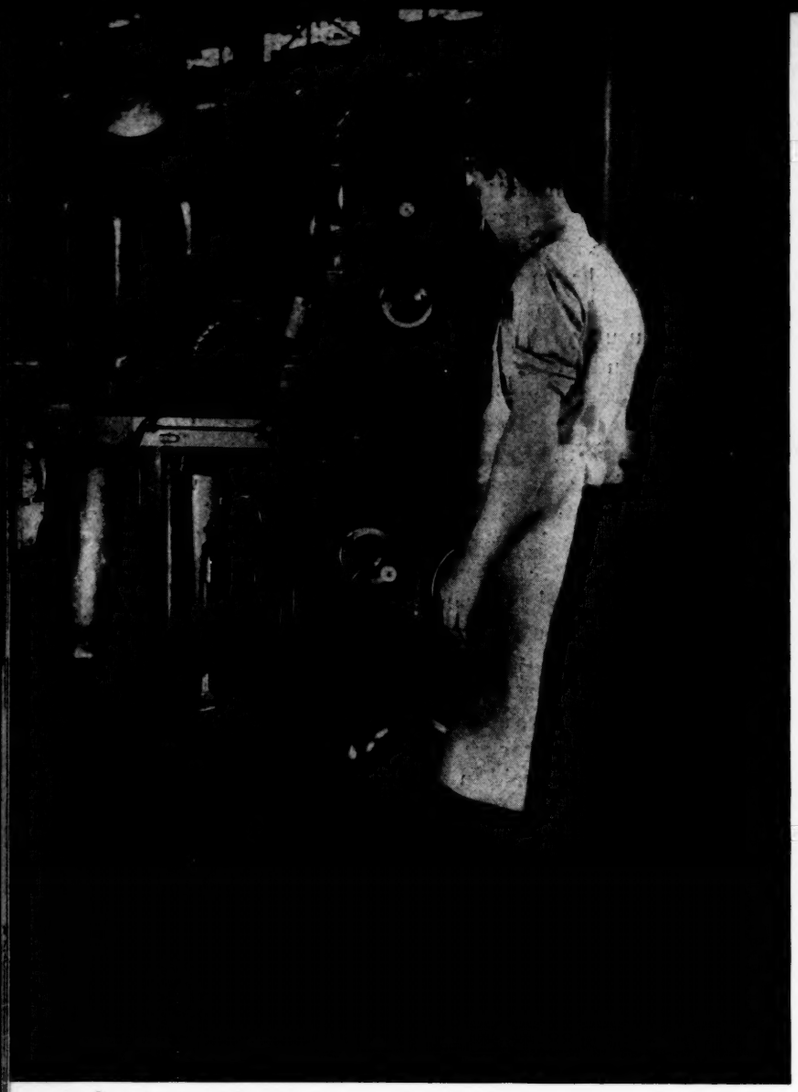


Fig. 2. A closeup of a grinding machine showing the exhaust hood and riser at the left. On machines where the grinding wheel moves through a path other than its own rotation the hood is swiveled to allow it to follow the wheel. See Fig. 3.

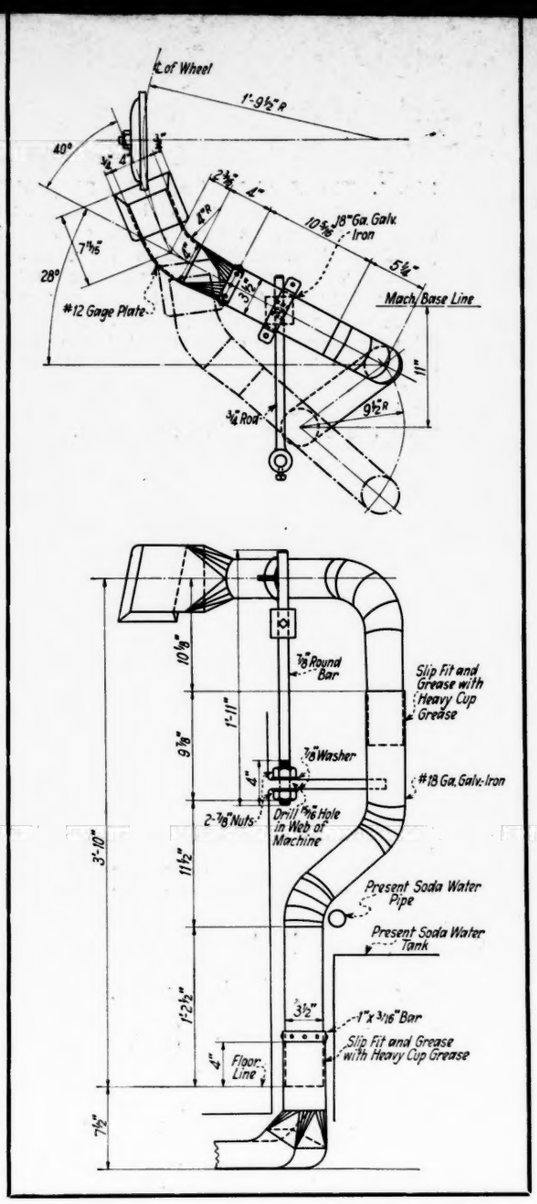


Fig. 3. Plan and elevational details of a typical hood and connections on a grinding machine. This particular layout is for a broach grinder. Dotted lines in the plan show range of adjustability of hood to accommodate machine movement. The ducts are all sweat-soldered air-tight. At the floor line the duct has a greased slip-fit joint where it connects with the under-floor branch. One hundred and ninety-one grinding machines are equipped with exhaust hoods, with the result that the absence of dust is quite noticeable.

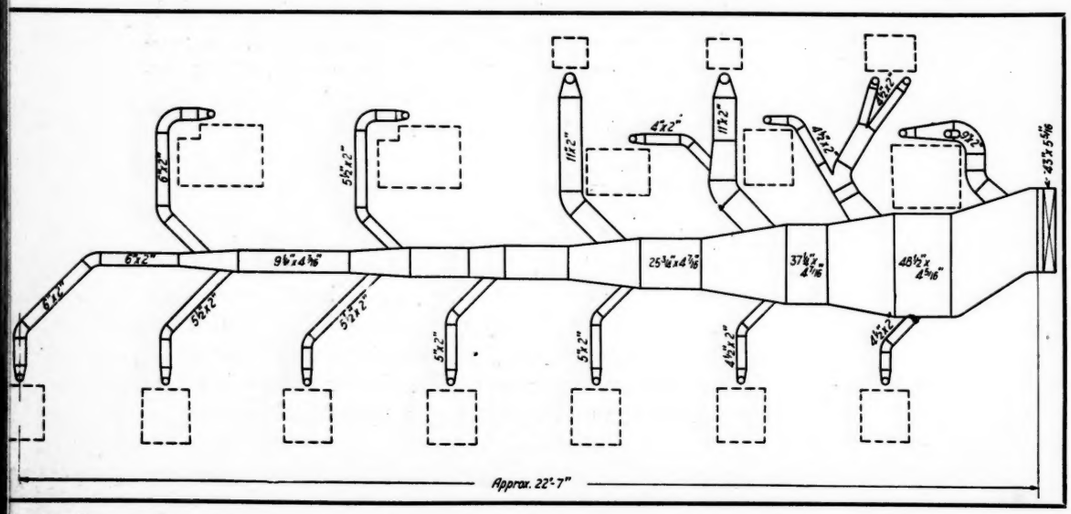


Fig. 4. Plan of ductwork in floor in a typical bay of the Tool and Die Shop. Dotted lines show locations of grinding machines served by this particular main and branches. All of the ductwork shown is concealed under the floor as far as the extreme right where it connects with a vertical riser. The branches are under the floor and covered over with wood blocks, while the mains are covered by plates. See Fig. 5.

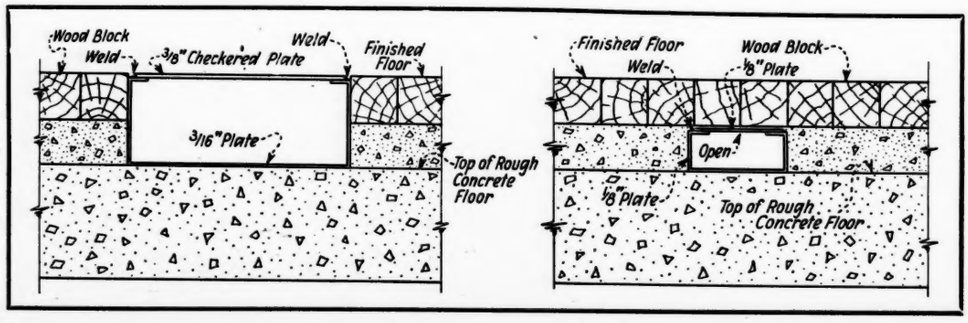


Fig. 5. Typical sections of the under-floor ductwork. The section at the left is one through a main duct and shows the checkered plate flush with the floor; this plate is removable at intervals to allow access to the duct. To the right is a section through a branch duct, concealed under the wood floor blocks.

Fig. 6. Overhead view of the risers of the grinding machine exhaust systems. The riser is offset and then turns upward through the roof to the dust collectors. The risers are so located along the walls that they are unnoticed unless one looks for them.

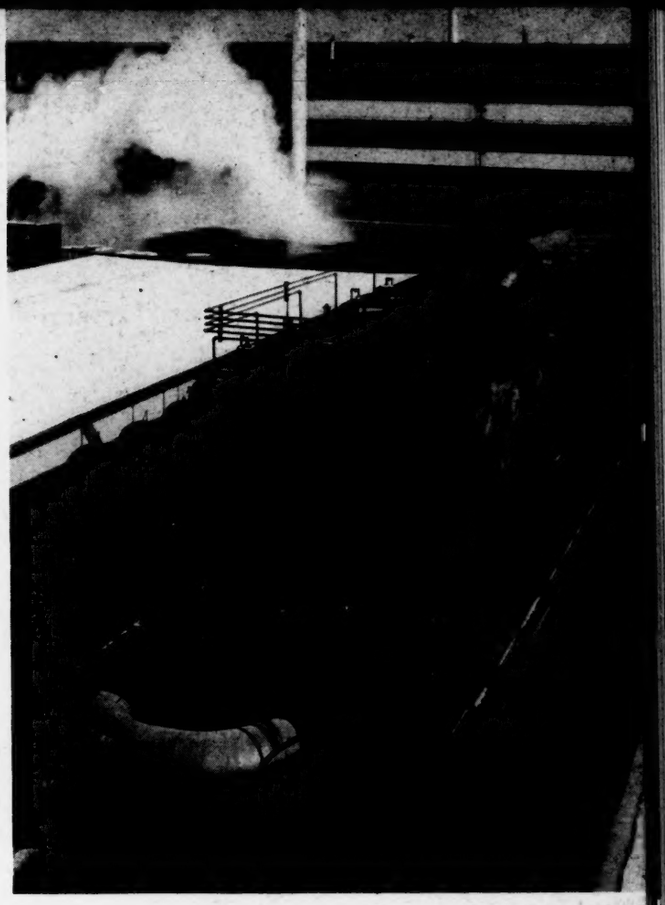


Fig. 7. A typical bank of dust collectors on the roof of the Ford Tool and Die Shop. These collectors operate automatically, with dust laden air passing through one compartment of filter bags while another set of bags is being cleaned by the shaking mechanism. The dust falls to hoppers below, while the clean air is exhausted to the atmosphere.

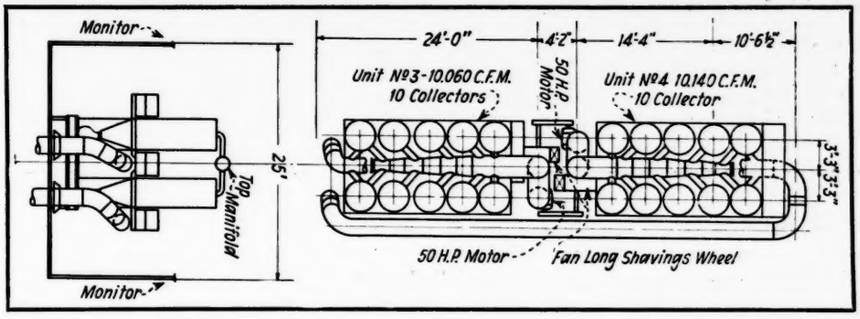
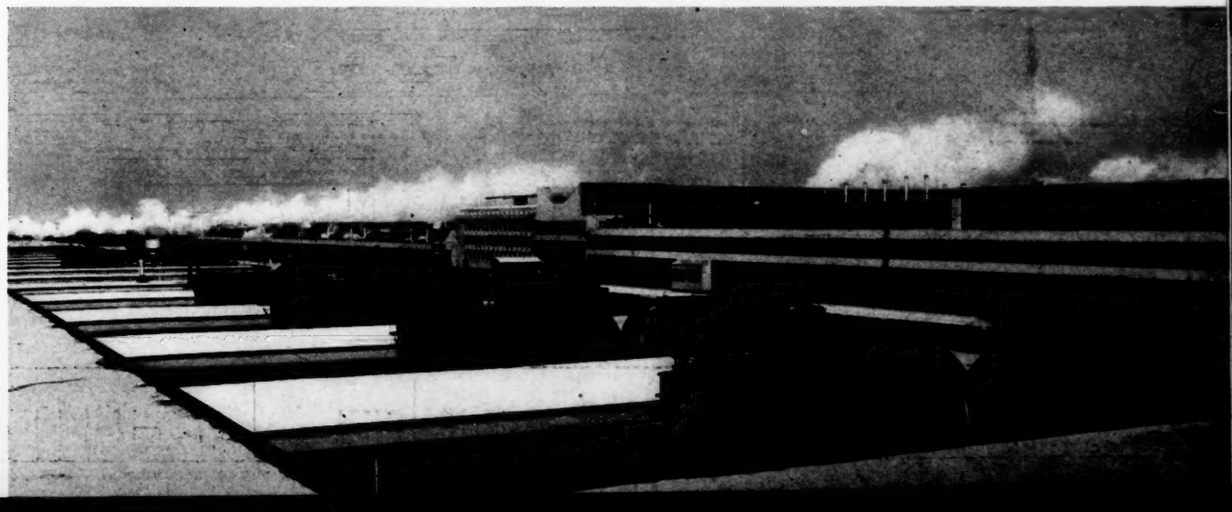


Fig. 8. Plan and bay elevation of typical dust collectors on the roof of the Ford Tool and Die Shop. This drawing shows units 3 and 4 only. The cleaning operation in these collectors lasts from two to four seconds. The cleaning mechanism is a shaker which agitates the bag by compressed air.

Fig. 9. A view along the roof of the Ford Tool and Die Shop showing several of the banks of dust collectors. There are a total of 92 collectors handling 92,000 c.f.m. of air. The Tool and Die Shop has 15½ million cubic feet of heated space and is said to be the largest plant in the world used entirely for tool and die work.



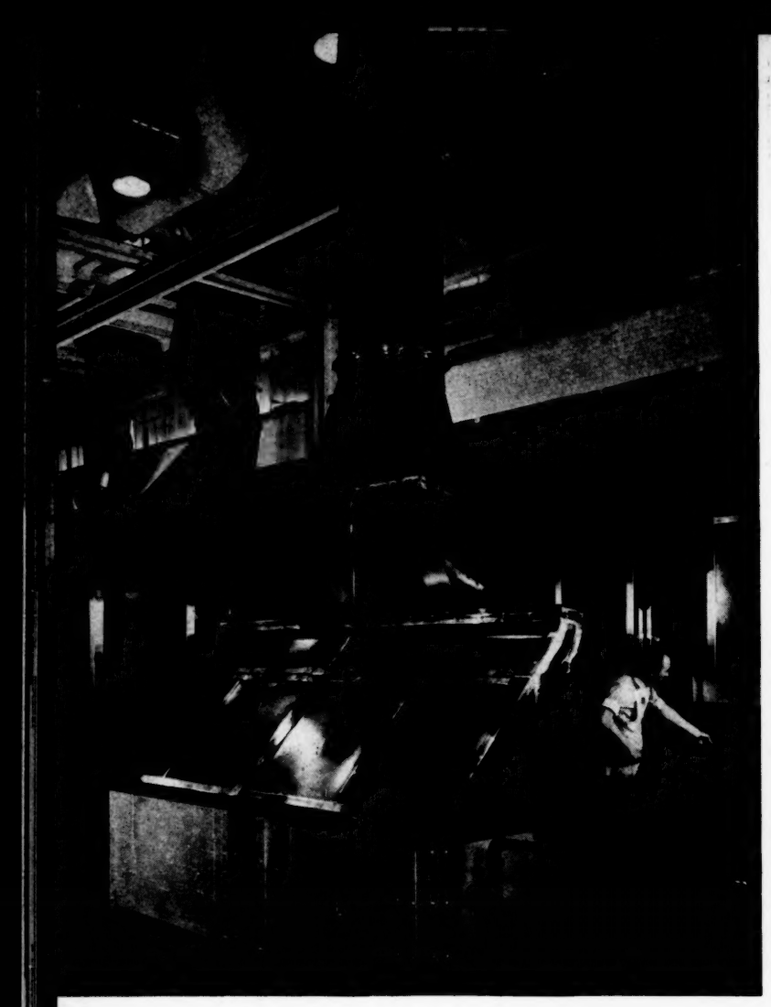


Fig. 10. Exhaust from the nitrating pot. The exposed ductwork in the fume exhaust systems is of Wellesville iron which gives a finished, smooth and pleasing appearance. In addition, no paint is required for this material. Overhead to the left can be seen one of the gas escape valves. These valves are located close to the fan on the suction side. When the fan is not running the valve is open and the gases flow out by the natural stack action.

Fig. 11. General view of the hardening room in the Ford Tool and Die Shop. The enclosure to the left covers the furnaces along the west wall, and this enclosure is also covered with Wellesville iron, and no bolts or rivet heads are visible. The arrangement of the apparatus shown here is illustrated in detail in Fig. 12, where the enclosed furnaces at the top are those at the left in Fig. 11.

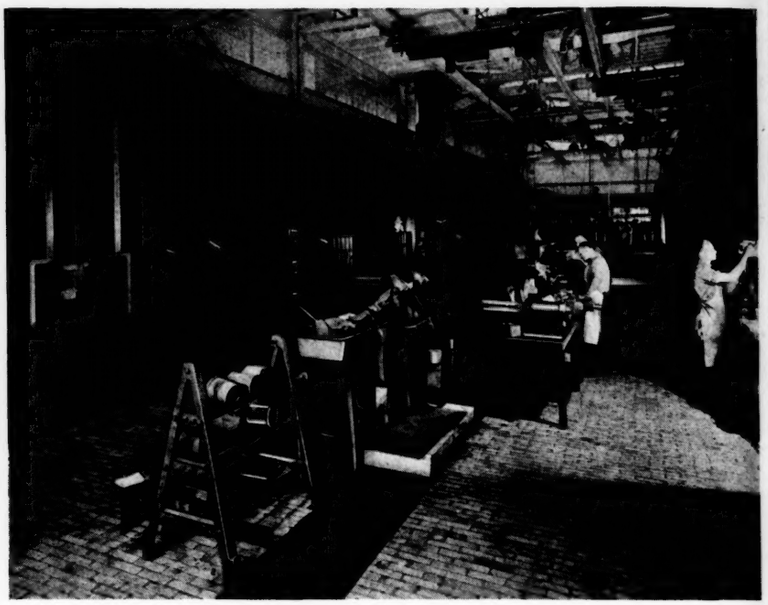
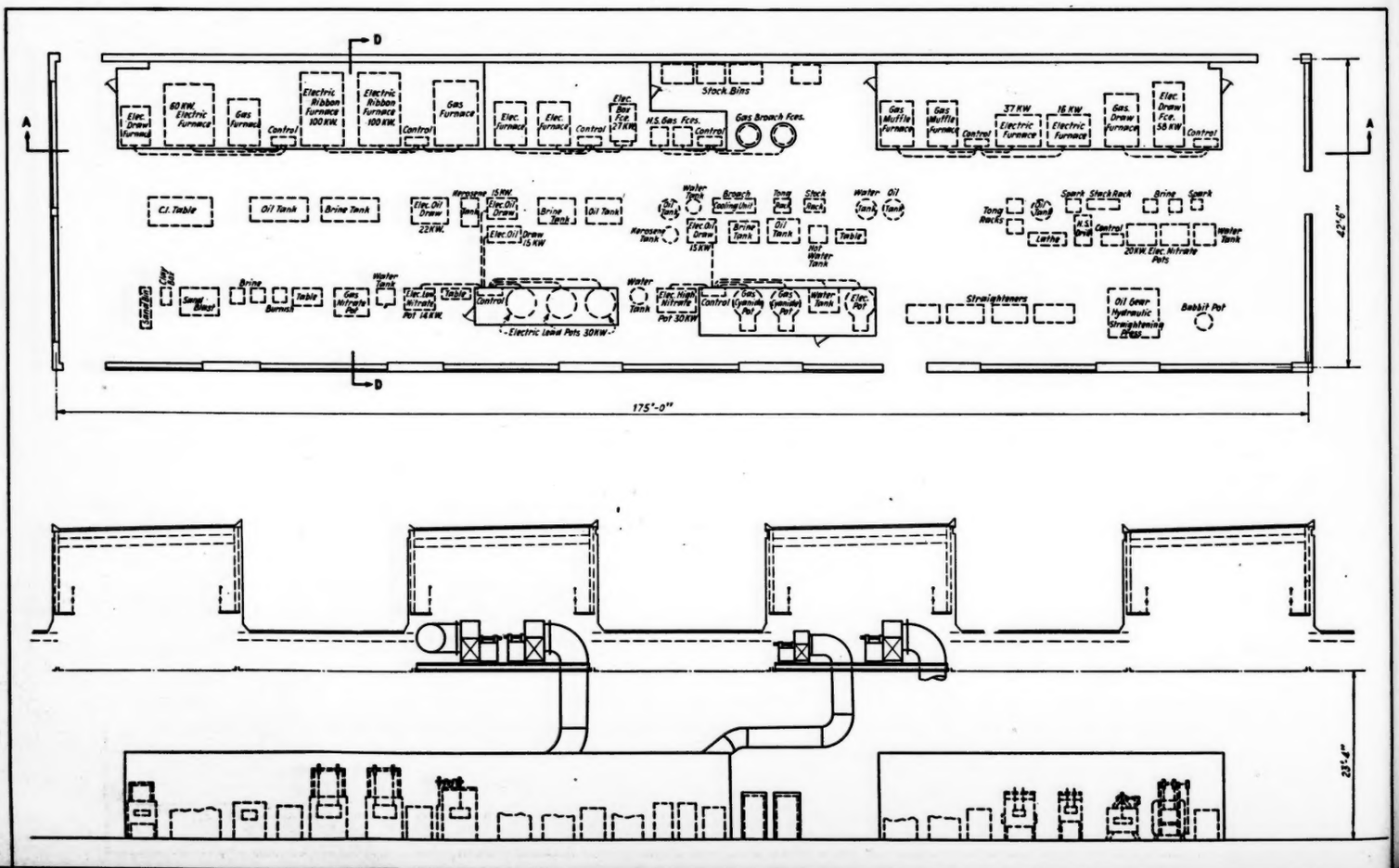


Fig. 12. Plan and section AA of the hardening room in the Ford Tool and Die Shop, showing location of the equipment. The section, below, shows the location of the fan platforms, located 23 ft. above the floor level. A natural draft stack is provided for the cyanide pots shown in the center of the lower row of equipment in the plan at the top of the drawing below.



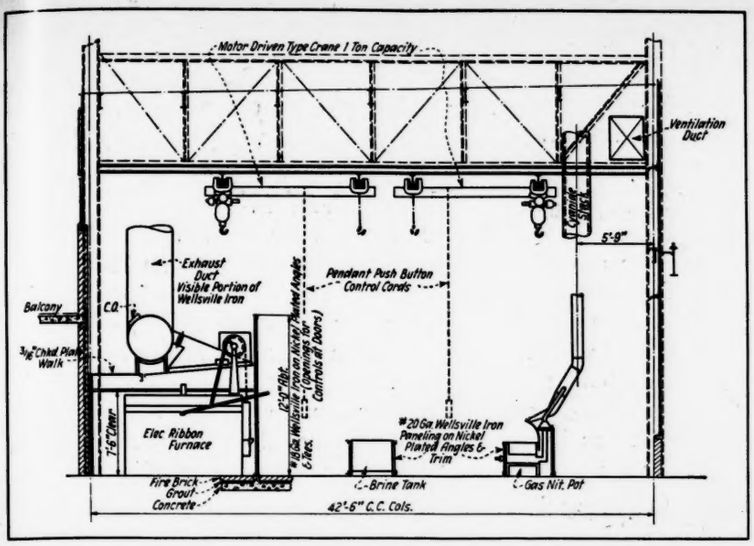


Fig. 13. Section DD, Fig. 12, showing arrangement of typical furnace, furnace front and method of connecting exhaust duct. Note how the Wellesville iron front extends above the furnace, concealing the outlets and mechanisms around the furnaces. The net effect of the enclosure is to give it an appearance resembling an instrument board.

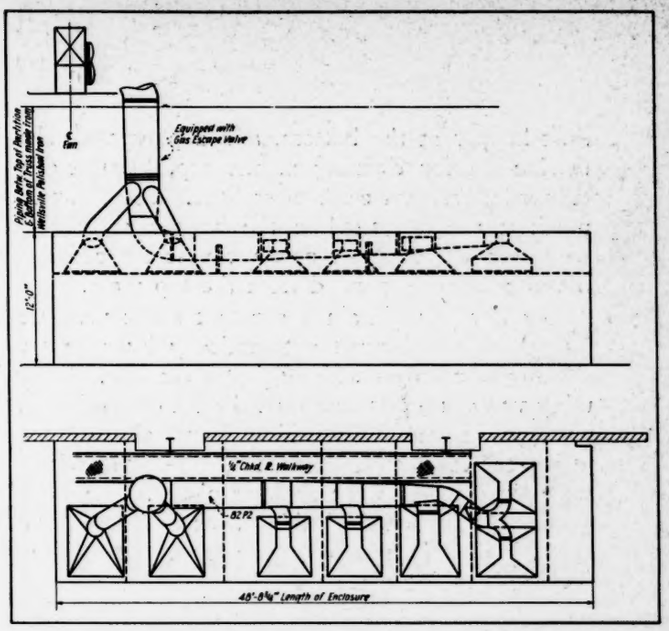
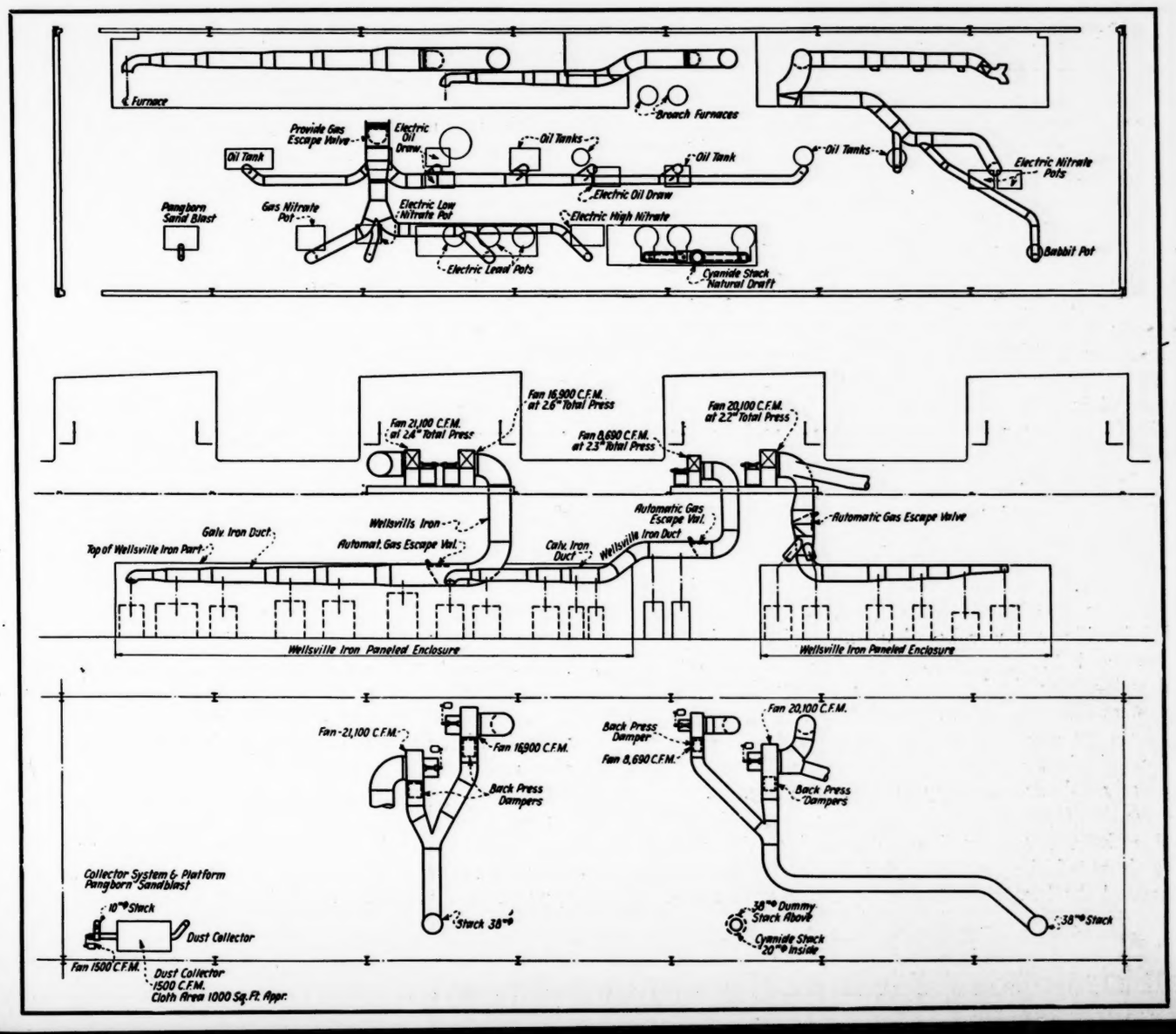


Fig. 14. Plan and elevation of the ductwork over some of the furnaces along one side of the hardening room. Forty-four heat treating furnaces are provided with exhaust ducts. There are four mechanical exhaust systems and one natural draft system. Fig. 15 shows the general arrangement of these in plan and elevation.

Fig. 15. Plan (top) of exhaust ductwork along one wall of the hardening room. The elevation is shown in the center while the bottom plan shows the arrangement at the fan platform. The three systems along the west wall (upper row of plan below) have a combined capacity of 58,100 cu. ft. of air per min.



dust hopper at the bottom, and a plate with shaking mechanism for cleaning at the top, from which are suspended vertical cloth filter bags. The heavier dust particles are deposited in the hopper at the bottom while the air and finer particles pass upward through the filter bags suspended from the top plate.

In order to maintain a constant static pressure the filter bags are cleaned automatically by a pneumatic shaking mechanism which agitates the bag. A distributing valve supplies compressed air to each filter compartment in rotation; the air pressure closes a damper which cuts this compartment off the line and at the same time actuates the shaking piston. The agitation loosens the dust on the inside surfaces of the filter bags, and this dust falls into the hopper below. While this shaking is taking place a small amount of atmospheric air is admitted at the top plate, causing an air flow through the bags in a reverse direction. This air carries down into the hopper the dust which has been shaken loose from the filter cloth. This operation lasts some two to four seconds and while it is taking place air from the exhaust system is meanwhile passing through other similar compartments in the same unit. The relatively dust free air is then exhausted to the atmosphere.

Hardening Room Ventilation

A space approximately 175 ft. long and 42½ ft. wide located along the west wall of the Tool and Die Shop is given over to tool heat treatment and designated as the Hardening Room. Included in this room are ten electric furnaces, nine gas furnaces, two electric nitrate pots, and numerous brine, oil and water tanks together with a sand blast, babbitt pot, straightening press, and three gas cyanide pots. The exhausting of fumes from these furnaces and other equipments constitutes a special problem in connection with the ventilating of the plant.

As shown in Fig. 12 the heat treating equipment generally is arranged in three rows extending longitudinally through the hardening room. The furnaces are all located along the west wall of this plant and are arranged in three groups. In order that these furnaces should present a uniform appearance and be heat insulated from the working space an enclosure was built in front of all of the furnaces extending well above the tops of the furnaces. As far as possible the furnace doors and the operating mechanisms were arranged uniformly and the enclosure was covered with Wellesville iron. The net effect is quite pleasing and not unlike that of a long instrument board. The selection of Wellesville iron was based upon (1) its good appearance and (2) the elimination of paint, which would discolor from the heat action in a very short time. A type of construction of the enclosure was adopted which eliminates any bolt or rivet heads on the exterior surface. This makes for easy cleaning operations and greatly enhances the appearance. See Fig. 11.

Each of the furnaces is heavily insulated so that there is little heat sensible to the touch on the enclosure in front of the furnaces; nor is the heat loss from around the furnaces sufficient to heat up the room.

Fume Exhaust

Three exhaust systems serve the three general groups of furnaces along the west wall, and these have a combined capacity of 58,100 cu. ft. of air per minute. To the top of each furnace an exhaust duct is connected, and these ducts in turn feed into one of the three mains, which are provided with automatic escape valves, and which lead up to fans located on a fan platform about 23 ft. above the floor level.

The danger of gas explosion, due to gas leaks or accumulation in the mains, is eliminated by these automatic gas escape valves. These valves are located close to the fans on the suction side. When the fan is not operating, the gas escape valve is open and any gases in the ducts would pass out into the upper portion of the room by natural stack action. To permit the further passage of the gases to atmosphere, openings are provided around the stacks as they pass through the roof.

Where the risers turn upward toward the main, they are covered with Wellesville iron in order to improve the appearance of visible portions of the ductwork. Where fumes are hot and likely to discolor the Wellesville iron, as is the case with the cyanide pots, an inside casing with an air space between it and the outer shell is provided.

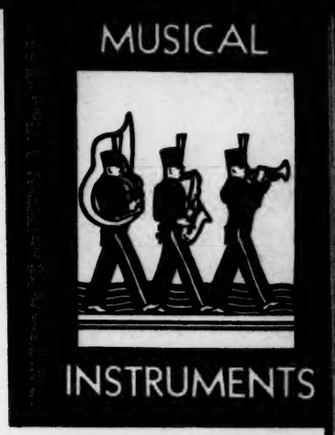
A fourth system serves the nitrate pots, oil tanks, and miscellaneous equipment located along the center and the east wall of this hardening room as shown in Fig. 15. In addition, the cyanide pots, due to the nature of the fumes, are served by a natural draft stack which leads directly to the roof.

Exhaust air from the fans escapes to the atmosphere through roof stacks. In order to prevent the fan from discharging back into the building when one is shut down, each line is provided with a back pressure damper, which is kept open by the flow of air through the pipe, but which closes automatically when the fan is shut down. This damper also prevents heat loss from the building by preventing the passage of warm air to atmosphere by stack action. Of the four mechanical systems, two feed to one stack, two to another; the cyanide pot stack is the third.

Due to the difference in air volume carried by the stacks, each is of a different size. In order that these should present a uniform appearance on the roof the smaller stacks are encased in a false outer shell so that they are all of the same diameter and equi-spaced.

Conclusion

It is probably never possible to estimate accurately the economic value of exhaust ventilating systems such as have been described here. In this particular case the abrasive dust, which otherwise would have been constantly in evidence, more or less harmful to the workmen, and damaging to expensive polished gages and tools, has been almost completely eliminated; disagreeable and in some cases dangerous fumes are removed from working areas, and, in accomplishing these objectives, no light has been obstructed nor has appearance been sacrificed. It is no overstatement to say that the exhaust systems in the Ford Tool and Die Shop approach the ultimate in good plant housekeeping.



C. G. CONN LTD.

band instrument manufacturer, has a unit heater installation synchronized with exhaust fans, serving buffing machines. When exhaust fans operate, heater receives all outside air; at other times, automatic control provides for recirculated air.

By FRANCIS A. WESTBROOK

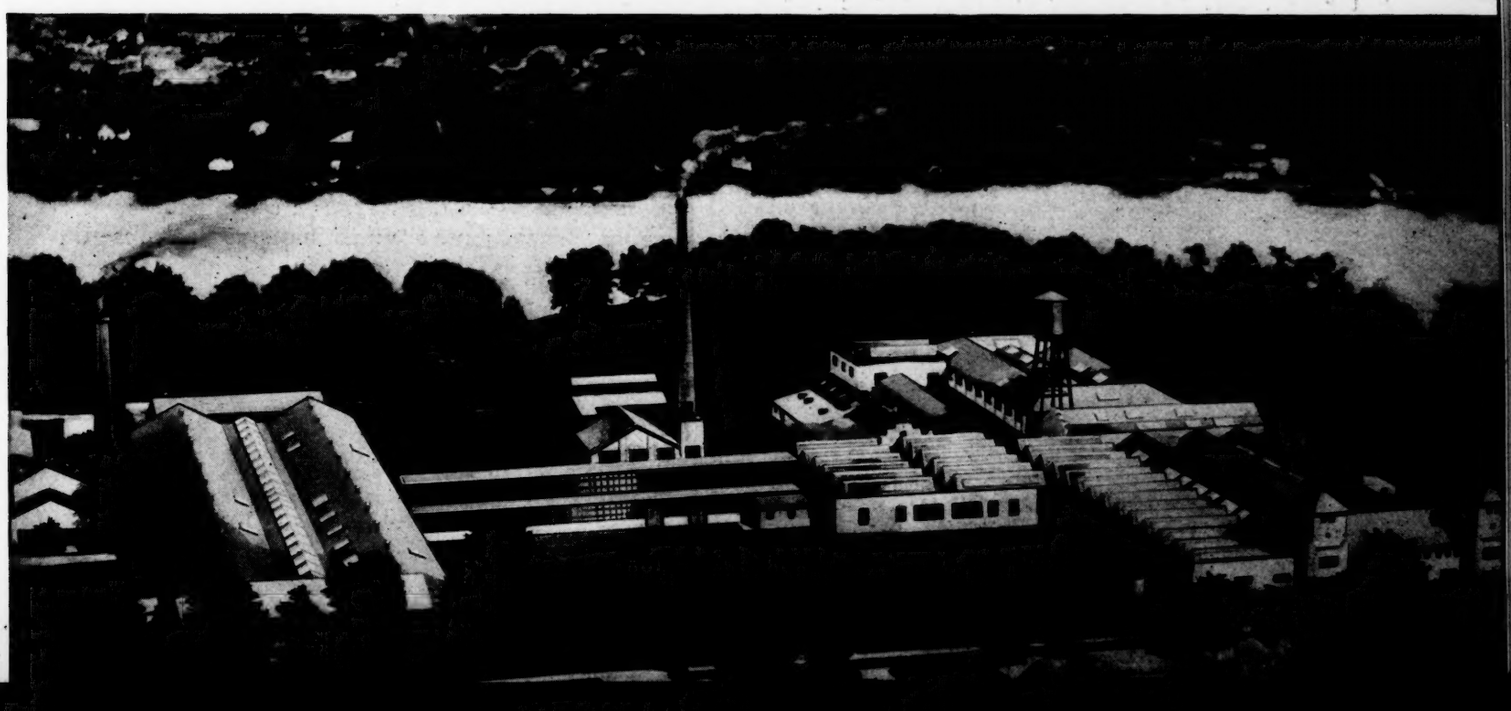
PROFITS IN AIR

NO. 20 OF A SERIES SHOWING HOW INDUSTRIAL PLANTS PROMOTE PROCESSES AND PROFITS BY SCIENTIFIC CONTROL OF AIR CONDITIONS

UNIT heaters are being used in the plant of The C. G. Conn Company, Elkhart, Ind., to supply make-up air for spaces containing exhaust systems, as well as for heating under a system of automatic control.

This company is the "World's Largest Manufacturer" of musical instruments. In the manufacture of these instruments it is necessary to do a large amount of buffing on machines which are arranged in groups, with a separate exhaust system for each group. These groups are not all in continuous operation, nor are they all in the same space. By the use of unit heaters an economical scheme was worked out for heating the buildings and at the same time for providing make-up air when one or more of the exhaust systems are in operation.

One large centrifugal unit heater was installed for each group of buffing machines. These units are of the inverted suspended type supported from the roof of



Air view of plant of C. G. Conn, Ltd., Elkhart, Indiana.

Fig. 1. Unit heater as used with monitor type roof where outside air connection is at the side.

the building. The intake of each unit has a mixing box with outside and recirculated air dampers. The position of the outside and recirculated air dampers is controlled by a two-position electrical damper motor. This is inter-connected with the exhaust system for the corresponding group of buffing machines by means of a relay in the circuit of the motor driving the exhaust fan.

Whenever the exhaust fan for a particular group of buffing machines is turned on, the relay in the motor circuit is actuated and causes the damper motor on the outside and recirculated air dampers to position the dampers so that all the air handled by the unit heater is drawn from outside. When the exhaust fan is shut down the damper motor swings to the other position so that the unit heater is supplied entirely with recirculated air. As a practical consideration it is to be noted that the unit heaters were so selected that the volume delivery of heated air from each is approximately the same as the volume handled by the exhaust fan for that group.

The room temperature is controlled by a set of bypass dampers built in the heating units and operated by a modulating damper motor positioned by a room thermostat.

Fig. 1 shows one of the units installed in a monitor type building where each unit is mounted up in a monitor with the outside air supply coming in through the side. Fig. 2 shows how unit heaters were installed at a later date in another building in this plant which has a flat roof, calling for a difference in the design of the mixing box. With this condition the outside air is brought in through an outside air connection run directly up through the roof.

All of the outlets on these unit heaters are equipped with adjustable vanes so that the direction of supply air flow may be controlled.

The advantages of this installation arrangement are several. By using cold outside air only when necessary by reason of the operation of the exhaust systems it is possible to secure a maximum use of recirculated air, with resulting economy in fuel. Having this automatically synchronized with the exhaust fan eliminates the human element and assures the economy. By splitting up the heating system to correspond with the various groups of buffing machines which are run off and on independently of each other, it is never necessary to heat more cold make-up air than is required to compensate for what is actually removed by each exhaust fan. This also makes it easier to maintain more nearly even room temperatures.

However, these installations were not installed primarily to save fuel, but rather to improve working conditions. The original installation was made in a new monitor type building and worked out so much better than the system used in the old buildings that the second installation was made in the flat-roofed buildings as a modernization project. With the old system, without any provision for make-up air the only way in which fresh air could get in was that which leaked in around windows and through doors, when the exhaust systems were in operation. This was not satisfactory for not only did it produce cold and drafty conditions adjacent to windows and doors but also interfered with the efficient operation of the exhaust system during the winter when the building was closed up as tightly as possible.

There are thirteen units in the plant, the majority being associated with the polishing blowers as described. In addition it may be said that these units are distributed, roughly, throughout the building so as to give adequate ventilation in all departments. While this may not be absolutely necessary it is looked upon as an advantage in this case, as a considerable number of small blower pipes are used in assembling operations for both silver soldering and soft soldering.

Fig. 2. Unit heater as installed with flat roof where outside air connection is at the top.

DUST CONTROL

in the granite cutting industry is discussed in this article, the first of a series which will describe the problem, summarize technical developments and outline the limitations of present day exhaust equipment.

By WESLEY C. L. HEMEON†

PART 1—EXHAUST DEVICES FOR HAND PNEUMATIC TOOLS

OCCURRENCE of silicosis among stone cutters in the granite monument and building stone industry, resulting from the inhalation of granite dust, is a well-established fact. (1).

The problem is widespread and has engaged the attention of governmental authorities in a number of states, notably Vermont (2), Virginia (3), Kansas (4), North Carolina (5), South Carolina (6), and Texas (7).

Investigations of the Massachusetts Special Industrial Disease Commission (8) disclosed widespread silicosis among the granite workers of that state and led to the establishment of the Massachusetts Division of Occupational Hygiene. The efforts of this agency respecting the problem have been oriented by the conviction that its most important function is to ascertain and promote the most positive and economical methods for control of the dust. In this it has had some success and it is the purpose of this article to describe the problem, summarize technical developments and outline the limitations of present day exhaust equipment.

Granite for building purposes and for monuments comes to the cutting shop in the form of rough blocks. Subsequent cutting operations are directed entirely toward producing a finished piece of predetermined shape, dimensions and surface characteristics. Certain mechanical operations such as sawing and polishing are done by wet methods, require a relatively small number of workers and do not generate hygienically important quantities of dust. The operations which generate dust in hazardous amounts, and which therefore require ventilation, are the various chiseling operations employing pneumatic hammers, sandblasting and, to a far lesser extent, hand chiseling.

The pneumatic hammers are of two classes. Surfacing machines are heavy mechanically-supported

PROFITS IN AIR

NO. 21 OF A SERIES DEALING WITH ATMOSPHERIC CONDITIONS IN INDUSTRIAL PLANTS.

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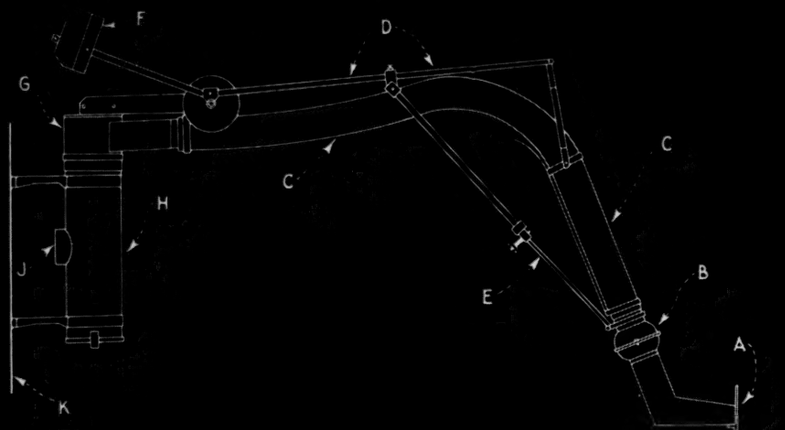

Fig. 1. Diagram of Commercial Banker Exhaust device. A, flanged hood. B, universal joint. C, rubber hose, 4-in. I.D. D, counterweighted hose support. E, telescoping friction rod. F, counterweight. G, revolving head. H, chip trap. J, duct connection to fan. K, wall or post support.

hammers used exclusively for producing a plane surface. They employ two types of chisels known, respectively, as the 4-point and the bushhammer. The 4-point, for coarser work, is the greater dust producer of these two. In the second class of pneumatic hammers fall the hand-held tools designed for detailed surfacing, shaping and carving operations. These tools employ a wide variety of chisels. Sandblasting, used mainly to produce lettering and designs in matte finish on polished surfaces, is usually done in an exhausted enclosure, the operator standing outside and directing the jet through a curtained slot. Machine surfacing, banker[1] work and sandblasting are carried out in the order named; the dust control requirements of each will be discussed separately.

For effective results, an exhaust hood used with hand pneumatic tools must be easily and quickly movable because of constant shifting of the working area.

One of the early types (9) consisted simply of 17 feet of two-inch hose supported by a pulley suspended on a weighted arm. Although two-inch hose is inadequate because of excessive resistance to the flow of air, it was presumedly employed because of the flexibility provided by hose of such small diameter.

In 1930 (10) an installation of movable exhaust hoods, with increased capacity and markedly improved mechanical flexibility, was made in a small granite shed in Quincy, Massachusetts. This device, later patented (11), (see Fig. 1) comprised about eight feet of rubber hose of three and one-half inches diameter, with a telescoping support and counterweight with friction fulcrum. With this arrangement the exhaust hood could be held in space at almost any desired point within a radius of nine feet of a pivoting point.

Another installation was made in 1932 comprising an all-metal flexible structure which, by means of pivoting elbows and telescoping pipes, enabled an exhaust hood to be quickly located at any desired point within a radius of six feet. A recently issued patent (12) (see Fig. 2) describes this device. In 1934 a patent was granted (13) for a device similar to this one.

Both of the devices in Figs. 1 and 2 have been found to be especially practical for use on small sized stones because of the convenience of manipulation. More recently, modifications in the design extend their usefulness to work on large stones. This is accomplished by the provision of flexible extensions which increase their effective radius to as much as 16 feet.

In 1933 Hatch designed and supervised the installation of a successful exhaust system in Chelmsford, Massachusetts. The banker exhaust arrangement consisted of four-inch diameter flexible hose, connected at one end to an exhaust main and fitted at the other end with a flanged hood made of rubber. By use of metal connectors the hose may be lengthened or shortened to suit the work. The use of such hose without mechanical support is facilitated somewhat by careful placing of the stone with relation to the exhaust system. Strict supervision insures use of the devices at all times and the workmen have become very adept in their manipulation.

Volume of Air Exhaust Required

The extent of the zone of influence of an exhaust hood depends upon the flow characteristics of the hood and the volume of air exhausted.

Hatch, Drinker and Choate (14) concluded from laboratory studies that a linear air velocity of 200 ft. per min. induced at the point of the tool by an exhaus hood is adequate to capture the dust formed by hand pneumatic tools. Air velocities induced by an exhaus hood decrease rapidly as the distance from the hood increases. Therefore, the effective zone of influence in this case lies within the area around the hood where the velocities are 200 ft. per min. or greater. This effective zone of influence is especially significant, since it governs largely the frequency with which the hood must be moved as the work progresses from one part of the stone to another. In practice this zone is definitely limited if we are not to exceed normal power requirements.

For any known air volume with a given banker exhaust device one may approximate the effective radius of influence from the relations developed by DallaValle and Hatch (15). The power requirement may also be calculated from a knowledge of frictional resistance through the device in question.

[1] "Banker" means workplace and has come to mean, specifically, a workplace for hand tools.

GRANITE CUTTING

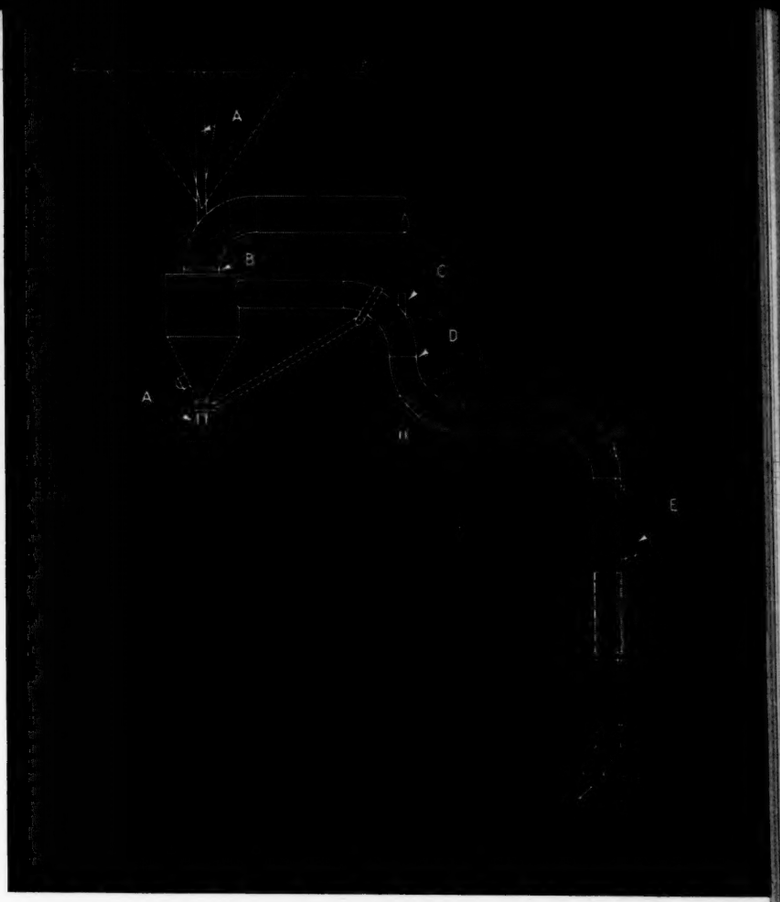

Fig. 2. Diagram of Commercial Banker exhaust unit. A, shaft around which entire unit rotates (roller bearing). B, joint between fixed ductwork and rotating unit. C, shaft around which lower portion of unit rotates. D, joint for independent rotation of top and bottom sections. E, device for raising, lowering, and locking slipjoint in position.

The DallaValle and Hatch equation for calculating the necessary volume of air to produce a desired air velocity at any given distance from the hood face is given by the expression

$$Q = V\,(10x^2 + A)$$

Where Q = volume of air, cubic feet per minute,
V = desired air velocity, feet per minute,
x = distance from hood opening, feet,
A = area of hood opening, square feet.

For a flanged hood the necessary air volume according to these authors is about three-quarters of the above value. Since the limiting air velocity for granite cutting is 200 ft. per min. and the hood on a common commercial banker exhaust device which we shall designate as R has a face area of 0.125 sq. ft., we may write for our specific case,

$$Q = 1500x^2 + 19 \quad \ldots\ldots (1)$$

The normal power required for operating an exhaust system is given by the relation,

$$HP = \frac{Qh_f}{6356}$$

Where HP = horsepower
h_f = combined static suction and pressure on the fan.

For the commercial device R we have established (16) an average pressure drop of 3.6 in. W.G. with a flow of 400 c.f.m. through the unit. This represents friction loss through the unit plus velocity head in the 5-in. pipe leading to the fan.

Since, for a given system, h_f varies with Q^2, we can now express h_f in terms of Q:

$$h_f = \left(\frac{Q}{400}\right)^2 \times 3.6 - \left(\frac{Q}{0.1364 \times 4005}\right)^{2*}$$

$$= (1.92 \times 10^{-5})\,Q^2 \quad \ldots\ldots (2)$$

Substitute for Q, its equivalent as given in equation (1) thus,

$$h_f = 1.92 \times 10^{-5}\,(1500x^2 + 19)^2$$

Assume a static efficiency for the fan of 50%, whence

$$HP = \frac{1.92 \times 10^{-5}\,(1500x^2 + 19)^2}{0.50 \times 6356}$$

$$= 6.03 \times 10^{-5}\,(3375x^4 + 127x^2 + 1.62x^2 + 0.4) \quad \ldots\ldots (3)$$

*The latter term gives the velocity head to be deducted from the pressure drop.

This equation expresses the relation between the horsepower required by a fan to create a velocity of 200 ft. per min. at any desired distance x (in feet) from the hood when using the banker exhaust device R. It will be noted that the greater the distance from the hood, x, becomes, the more nearly the horsepower requirement is a function of the 6th power of that distance. It is apparent that a point is soon reached beyond which it is not practicable to go.

Equation (3) is expressed graphically in Fig. 3, which shows also the horsepower characteristics of another commercial banker exhaust device, designated as B. The general form of the equation for unit B is the same as equation (3) but the constants differ because of different friction losses in the units.

It is clear from inspection of the curves that beyond a radius of six or seven inches the power requirements increase to unreasonably high values. To provide a radius of influence of six inches with device R requires about 0.38 horsepower; for 7-inch radius, 0.90 horsepower; and for 8-inch radius, about 2.05 horsepower, for each banker.

The Massachusetts standard of recommended practices (16) for installation and operation of banker exhaust devices takes account of these facts. It specifies a minimum radius of influence of six inches—the distance from the hood at which a velocity of 200 ft. per min. should be induced when the hood is suspended without obstruction. For a flanged hood this requirement is met by exhausting 400 c.f.m.

Clearly, the existence of the 6th power relationship is inherent in the characteristics of all such devices in

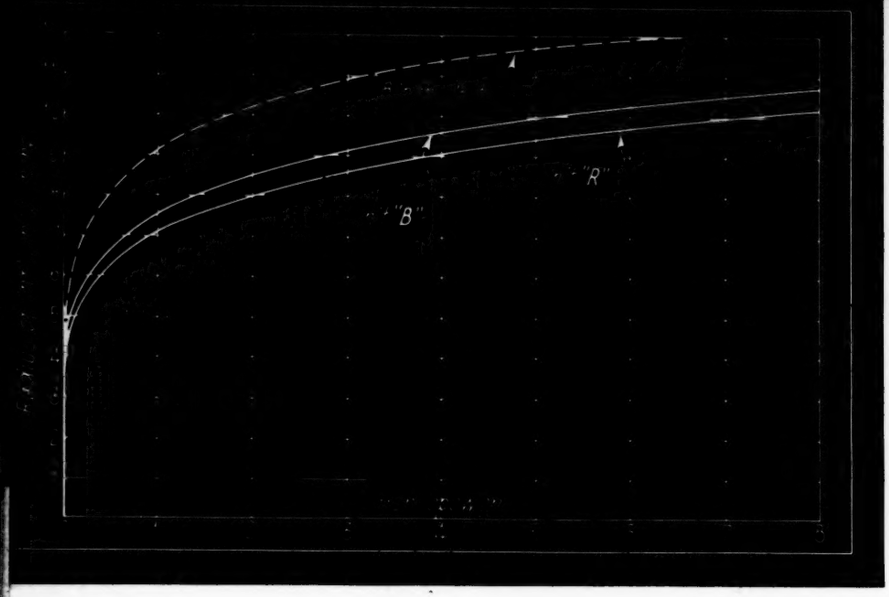

Fig. 3. Characteristics of banker exhaust devices showing power required to induce a velocity of 200 ft. per min. at varying distances from the hood face.

which a movable exhaust hood is independent of a source of dust. However, improved design can extend the practical limit by decreasing frictional resistance. This means an increase in the diameter of the duct work and this, in turn, is limited in practice by the necessity for flexibility and convenience in operation.

The dotted line in Fig. 3 shows what the characteristics would be of an exhaust device like unit B, with a decreased frictional resistance resulting from increases in pipe diameters from five and six inches to seven and eight inches.

Tool-Attached Exhaust

Various attempts have been made to develop an exhaust hood for hand operated pneumatic tools to permit a more nearly constant withdrawal of dust at its source, and among those which frequently recurs is the tool-attached exhaust. The general idea is illustrated in Fig. 4 (17). Operating difficulties arise, however, with the hood attached directly to the tool to the extent that the tool is thrown off balance and, even though it is possible to make the exhaust hood and duct of very lightweight material, the problem of providing a flexible duct leading to the source of suction is one which has thus far been insurmountable.

Another approach to this problem worthy of note is a development attempted in Barre, Vermont (18), which is illustrated in Fig. 5. In this device an annular space was provided in the barrel of the pneumatic tool itself with a rubber hood at the chisel end, and flexible hose of small diameter leading away from the upper end of the tool fastened to and running parallel with the compressed air hose. Under certain conditions it was found that an exhaust of 40 c.f.m. from the rubber hood provided good control of dust. Resistance to the passage of air, however, through the annular duct in the tool and thence through three or four feet of flexible hose leading from it, was found to be around 40 inches of water. A further disadvantage of this device was the difficulty of bringing the air inlet close enough to the cutting point to be effective when using fine carving chisels, without interfering with the work. In spite of this ingenious integral design, workmen complained of its being awkward to handle, presumably not because of the barrel modification but rather because of the hose connections. Abrasion of the metal surfaces bounding the annular space by the dust might be expected to be excessive although this does not, of itself, appear to be a fatal difficulty.

Exhaust Booth

Leitch describes an arrangement (19) in which a booth or stall is provided with a propeller type exhaust fan at the rear, as in the case of an ordinary paint spraying booth. The stone is mounted at the entrance to the booth on a turntable which permits the workmen always to be in a position to avoid the current of dusty air. In lieu of a dust filter for exhaust air it is proposed to discharge it into a stack 30-40 feet high. An advantage is that the removal of dust is independent of any action or inaction on the part of the workman. Some disadvantages are, (1) illuminating the working area to suit workmen (natural illumination is vastly preferred whenever the weather is favorable), (2) inconvenience of handling stones of large size, (3) in heated sheds in winter the large volume of air to be withdrawn represents a relatively large heat loss, (4) where filtering of exhaust air is necessary as in congested districts it would not be practicable to do this with the propeller type fan employed.

It is possible that most of these disadvantages may eventually be overcome, and it would seem that the general idea warrants further consideration. At this writing the system has not been used commercially to any extent.

Design of Duct Work

Transporting Velocities: Duct sizes for dust removal systems are designed in accordance with the required air volumes and the minimum transporting velocities for the dust. Since power consumption varies with the square of the velocity, it follows that this factor has

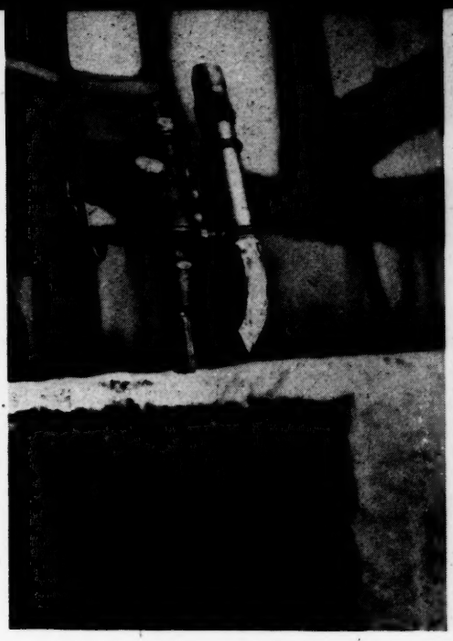

Fig. 4. Exhaust hood attached to tool. Although this arrangement could provide excellent control of dust, it has never proved practical. Fig. 5. Pneumatic tool with built-in exhaust. Exhaust air passes up through annular space in barrel. Various shapes and sizes of rubber hoods were to be attached at bottom of barrel. Note exhaust hose connections at top end.

considerable economic significance and should be held at a practicable minimum.

The minimum transporting velocity for granite dust is commonly taken as 3000 ft. per min. Personal observation of the operation of exhaust systems successfully removing granite dust generated in hand pneumatic tool work has demonstrated to the author that velocities as low as 2000 ft. per min. are adequate to maintain this dust in suspension. If such is generally the case, it would seem that exhaust systems to convey granite dust designed for velocities of 3000 ft. per min. will operate with a considerable factor of safety. On the other hand, temporary reduction of the velocity in mains caused by some branches of the system being cut out by dampers rarely result in dust settlement. In the case of exhaust systems for the usual small granite shed there is very little saving in power to be realized from a decrease in pipe velocities below 3000 ft. per min. except occasionally where there is a long run of small diameter pipe at the end of a line. It is, therefore, usually satisfactory to base the design of such systems on a minimum transporting velocity of 3000 ft. per min., bearing in mind, of course, that where a real advantage results, pipe areas may be increased 50% with impunity.

Balancing Flow of Air Through Branches: In a multiple exhaust system where several branches deliver to a main duct, those branches nearest the fan will draw a relatively greater proportion of the total volume of air than those farther from the fan. However, when the resistance in branches is great relative to that in the mains (as in flexible banker exhaust systems), the disparity in air flow between branches is small. For this reason there is little advantage to be gained by attempting to *balance* the flow in an exhaust system of this type by increasing frictional resistance in those branches nearest the fan. Another reason for disregarding such differences in flow is that the volume of air specified to be delivered by each branch is a minimum figure and the net result is that hoods of branches nearest the fan will have a little greater radius of influence.

Fan Size: The cross-sectional area of the main duct at any point should equal, approximately, that of the branches preceding it. With this method of design and with velocities in ducts of about 3000 ft. per min. it is found that an exhaust fan (steel plate exhauster) with an inlet diameter about equal to that of the final section of the main duct will usually be of proper size.

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Facts and Fallacies in Heating Piping

PART 3—WET AND DRY RETURNS

By T. W. REYNOLDS

This is the third part of a series of articles in which the author makes some suggestions and criticisms regarding common steam piping practices. The first two articles appeared in April and May issues. The next part of this series will appear in June.

FIG. 10 shows the standard way of connecting the end of a steam main to a wet return while Fig. 11 shows the way the steam fitter usually does it because the fitting at the end invites the convenient insertion of a quick vent at minimum expense. The writer has found the latter method to be just as satisfactory as the former, except on a foaming job where the steam main is rather close to the boiler water line. This brings us back to the fact that with the proper water, boiler, chimney and radiators and with proper size and grade of pipes, one can take almost any liberty desired with the manner of connecting the pipes. It is only when the system is generally weak all along the line that one must become more choosey as to the precise method of piping connection to be used. There is one set of standard piping connections which should be used in designing or erecting of a new job and another set which must be used on a job already in place which is not properly installed.

A foaming system can be cured for the time being, but it cannot be maintained that way unless the proper attention is given to it as time passes, nor can a condition where the boiler water line is too close to the steam main be corrected short of unreasonable expenditure. With these facts in mind it would seem in all cases where the water is dirty and the water line too close, that the air valve could be elevated to a higher point, preferably with larger or even full size pipe in order to minimize the contact of water with the valve. Better still, a slow venting type of air valve could be used which operates with least trouble where water is a factor, and this could be placed as far back on the steam main as possible to near the last runout. In this event, the air valve need not be elevated on an extended pipe because it is well removed from any contact with water in the vertical drip and also has the advantage of being located at a higher point the further back it is.

Fig. 10 is supposed to have certain advantages in that the water is carried freely over with a full size fitting and full size pipe part of the way. Effect of a dancing water line is supposed to be minimized as it surges up into the larger pipe, that is, a given volume of water surging quickly upwards from the smaller size of vertical drip pipe cannot rise very high above the

A NOTE BY THE AUTHOR

Standard piping connections are slavishly reproduced and passed on from one author to another. Quite often they also form an impressive part of our plans and a sacred niche in the specifications. Here they receive most honorable mention before being passed on to the contractor, yet the advantage of many of these connections seems extremely doubtful. This, we do know: they serve but to increase the cost.

These so-called standard piping connections were not originated in this era, but are hangovers from opinionated ideas of long ago which having gained vogue are now hard to dispel. They show little or no change from those thirty years back, notwithstanding the rapid changes that are continuously taking place in practically all other phases of heating.

The need for each of these connections is commonly defended by certain assumptions, or by a line of reasoning which off-hand seems logical because the reasoning is not pursued far enough. Such reasoning might have had some justification in other days where water in pipes was a troublesome factor and when but little was definitely known of what actually took place inside a pipe or fitting. Today we have intensive research with glass pipes, colored liquids and with pipes whose arrangement may be quickly changed at will so as to produce any desired condition for experiment.

Experience acquired in contracting, as well as in trouble shooting over a long period of years at the rate of several trouble jobs per day, eventually caused the writer to show no hesitation in repeatedly violating with impunity many of these sacred traditions with no harmful results. With this in mind, the elimination of waste, and in some cases betterment of method, it is the writer's thought to present herein a number of changes in piping methods which the writer has found along with some others to be the better way. In general these piping methods refer to connections as used in a one pipe steam heating system. Connections common to other systems are so noted, or if not their application is obvious.

reducer, because of the greater volume which the larger pipe contains. Priming and foaming in the boiler is supposed to produce a pump-like action in the return, the piston or swing effect causing water to dance in the vertical drip from the end of the main. Actually, however, the foam and mingled water and steam as it undulates in the boiler is a rather light mass which affects nothing in particular except the carrying over of water upon occasion through the steam outlets due to lightness of its mass. Any effect on the return could be overcome by means of a check valve and where such check valves are used they have never been heard to chatter as one might expect from the suppositions made.

The final rebuttal to this line of reasoning seems to be that the water will stand, or rise as high, in the vertical drip at whatever height is required above the water line in the boiler for the additional rise of water column to balance by its static pressure the difference in pressure that exists between the boiler and the end of the main. Variations in boiler pressure from one moment to the other due to foaming could bring this about, but any such variations appreciable in amount would be indicated on the gauge and they never are.

If a foaming boiler must be tolerated rather than remedied and if this pump-like action actually does exist and is of importance, it would seem that it would be cheaper, because of less labor involved, to extend the end of the main vertically downwards full size to a reducing ell into the wet return. A more likely, though more expensive, way to remove such worries is by the adoption of the method as illustrated in Fig. 12. This method, in addition to the advantages previously outlined of high elevation for air valve and location well back from drip pipe, has also the advantage that any fluctuations in water line could be readily absorbed in the greater volume within the dry return. Of course, the dry return should be given a greater than normal pitch to prevent the fluctuations in water line from causing water hammer due to trapping of steam momentarily in the dry return, and of course this method should never be employed in the case of a dry return which is of considerable length and rather close to the boiler water line, because the usual rise of water above the water line would fill the long dry return and might lower the water in the boiler below safe limits.

The extension of an air valve to a higher point is unnecessary in a properly designed system. The real purpose of such extension is to keep the air valve from water logging and sticking from dirty water and to eliminate the annoyance and damage of water as ejected by a flooded air valve. If water rises high enough to create such conditions, it will also prevent the air valve from venting properly, due to blocking of the air inlet to the vertical extension piece.

Fig. 12 also presents some other advantages which are valuable enough to warrant mention in passing, particularly where the dry return is and can safely be of appreciable length. One of these is the saving due to reduction in length of the large steam main and its covering. Nor need the dry return be covered, as it is of small size and in most cases for most of the time contains only air and some water, instead of steam. In a vacuumized system there are occasions where for short intervals some of the contained air within the dry return will be reabsorbed elsewhere within the system while under vacuum, and in such cases steam will reenter the dry return whenever pressure is raised. Regardless of this possible and occasional condition, there is less heat loss from a small dry return even though bare, than from an equal length of steam main even though covered. Consequently some slight amount of fuel is saved, for it must be presumed that the reduction in heat loss is desirable and cannot be utilized to advantage in the cellar, or the steam main would not be covered.

Since the start of this script concerning the matter of proper air valve position, the writer came across

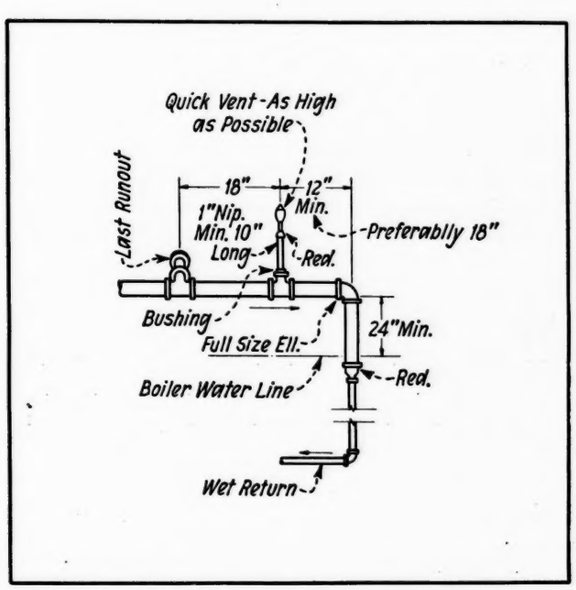


Fig. 10. Recommended method of connecting a steam main to a wet return as commonly illustrated in books.

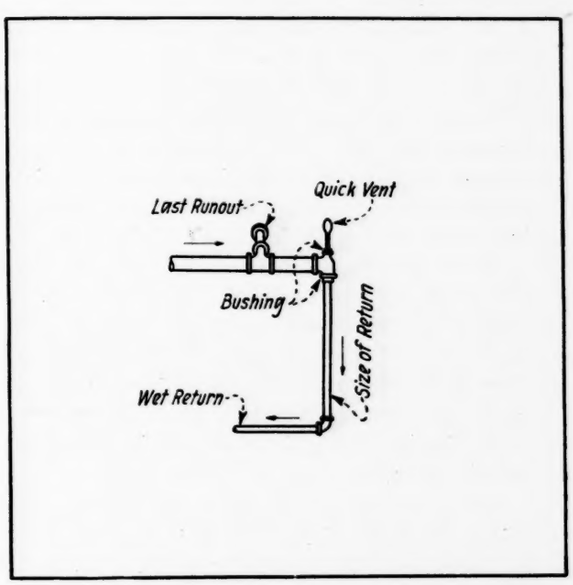


Fig. 11. Method of connecting a steam main to a wet return as commonly encountered in practice and which usually works.

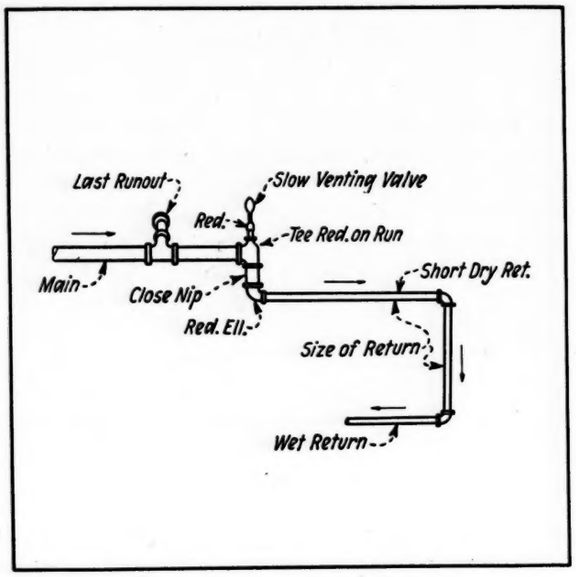


Fig. 12. Method of connecting a steam main to a wet return as suggested for troublesome conditions.

something along these lines which he has never seen before, and while it will not work as planned by its originator, it nevertheless was a very interesting attempt on the part of the installer to solve the old problem of how to prevent flooding of an air valve where this was installed down too close to boiler water line. Water had proved too troublesome with the former location of the air valve at the end of the steam main, so the fitter ran an air line from this point to the boiler outlet for the safety valve as shown in Fig. 13. Evidently the reasoning was that the air in the main would be driven out ahead of the advancing steam and flow back into the boiler from where it would again be driven out into the main and eventually find an outlet through the numerous radiator air valves. The fallacy of this reasoning lies in the fact that the steam in the end of the main is at a lower pressure than the steam within the boiler, hence the air cannot be returned through the air line against boiler pressure. Steam will leave the boiler and flow in the air line toward the point of low pressure.

Due written objection having been made to this condition, the writer returned to the job shortly after, only to find that the fitter, not to be outwitted, had substituted a quick vent valve for the safety valve, which accomplished nothing, as steam within the boiler would keep the air valve closed. What the fitter had in mind this time, aside from finding a more direct outlet for the air, was that he had finally found a place where an air valve could be installed down close to the water line, because as he reasoned there would be no pressure drop at this point.

Dry Returns Compared to Wet Returns

Inasmuch as certain advantages of a dry return were incidentally brought into the discussion a few paragraphs back, it should be fitting at this point to enumerate the various pros and cons that sometimes enter into the many discussions of dry versus wet returns and to truly evaluate the opinions held by different engineers. Both wet and dry returns have their disadvantages and any advantage of the one over the other is usually peculiar to the physical conditions of the structure in which it is installed.

A dry return may interfere with the required head room at doors and stairways and decrease the desired head room at other points in the basement. It is more in sight, requires labor and support, and in some cases has to be covered. Covering on pipes near the ceiling collects dust and becomes unsightly as it deteriorates. In large installations a dry return requires larger pipe than a wet return, and if the vent valve is installed at the end of a dry return it may be too close to the boiler water line. Dry returns contain distilled water in contact with air and corrosion may become rapid.

A wet return may have to be re-routed to avoid doorways, or in passing them pockets are created which are liable to deposits and freezing. Liability of stoppage due to sediment necessitates a minimum pipe size of 1¼ in. so that in many cases there is no advantage in using a wet return, in so far as the use of smaller pipe is concerned. It is difficult to clean around a wet return. Where covering is required it is frequently difficult to install and is likely to be destroyed easily. Sediment and freezing may cause trouble, and there is the possibility of a break or a leak emptying the boiler where the boiler is not safeguarded against such a liability.

Wet returns are supposed to afford a storage of hot water which will aid the boiler in quick steaming each time the boiler gets under way. The converse is true, because the water in a wet return not only cools faster than the water in the boiler, but is also continually losing heat, so that it is somewhat cooler than either the water already in the boiler, or the water as received from a dry return. The cooler water must be returned to the boiler, raised in temperature, and evaporated before the higher temperature water from the radiators becomes available, so that if anything wet returns become a handicap from this factor; furthermore, boiler water of today is customarily maintained close to steaming temperature by means of the usual aquastat.

The storage of water in a wet return has been said to be of advantage whenever the oil burner stops and a system goes under vacuum because this store of warm water provides the latent heat required to evaporate steam for continued circulation to radiators.

In the first place, if there is a check valve in the return, there will be no circulation from the return and none of its stored heat will be available for the purpose in question. In the second place, a wet return is usually down at the floor, from which elevation it rises either to a safety loop or to the boiler tappings; hence the warmer water of the boiler will not circulate down to and within the wet return to displace and force out the cooler water in the return. In the third place, even where the wet return is above the boiler tappings, the latent heat of evaporation will quickly cool the small amount of boiler water on an automatic job and soon slow up any such circulation. In the fourth place, no stored heat can be brought back to the boiler, because

circulation can take place only as the wet return gives up its heat to the basement, and this was the heat that was desired back in the boiler. In the fifth place, the return water cannot evaporate under the low prevailing temperatures because it is under static pressure, and in the sixth place, even if the return water were available at a temperature as high as 215F, the amount of stored heat for the purpose in mind would be negligible. This is due to the small pipe used for wet returns and the fact that where larger sizes and longer runs are used, there is a correspondingly larger demand. In the average residence installation a wet return would contain only enough water at 215F to make available no more than the heat as required to supply one very small radiator for about ten minutes.

Any heat loss of either a dry or wet return is of no disadvantage where such heat can be utilized in warming the floor above so as to decrease the floor to ceiling temperature differential and thus provide more heat in the living space. Generally, this point is not taken into consideration so that often the returns are covered and particularly is this true of the dry return which is supposed to lose more heat, due to its higher temperature, than a wet return which contains only water and is low down and tight to the floor. Therefore, a tenet contrary to received opinions would be to say that the covering on a wet return is of more value in reducing heat loss than similar covering on a dry return. Nevertheless a few figures and a little thought seem to place such a statement beyond legitimate contradiction. This is specially true when it is considered that whenever pressure leaves the system, the dry return soon cools, whereas the wet return continues to lose heat for a long period.

In the average residence installation, the wet return should be not less than 1¼ in. and the dry return need not be more than that size. Weight of metal in the pipes under comparison will then be the same, since size is equal and length should also be equal, because either pipe is considered as displacing the other. On the other hand, the metal in the dry return will be at a higher temperature than the average temperature of a wet return and therefore will contain more heat and cool at a faster rate in lowering to surrounding temperature. Rate of heat dissipation might also be considered greater for a dry return due to its higher position, but this should be partly offset by the fact that the air surrounding the dry return at the ceiling will be at a much higher temperature than the air surrounding the wet return at the floor.

A few trial figures indicate that no importance should be attached to any of these technicalities one way or the other, so that the problem narrows down to the amount of latent heat in the steam as left in one foot of pipe, versus the amount of heat above cellar temperature remaining in the water contained within an equal length and size of pipe after pressure dies down. No comparison need be made while the system is circulating as the temperature differential of two pipes should be more nearly equal at such times than at any other time.

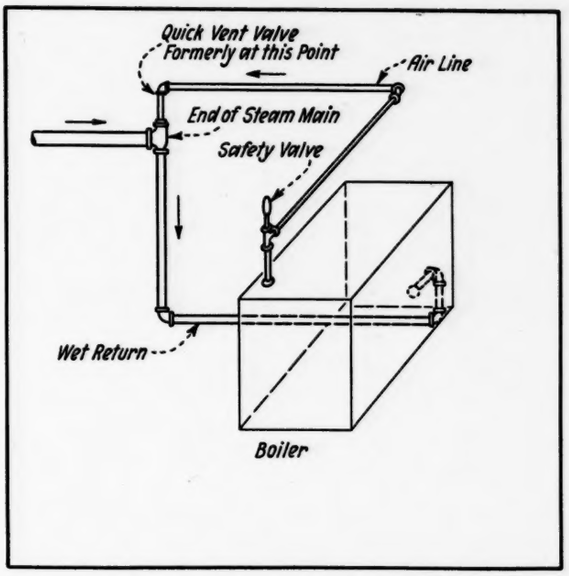
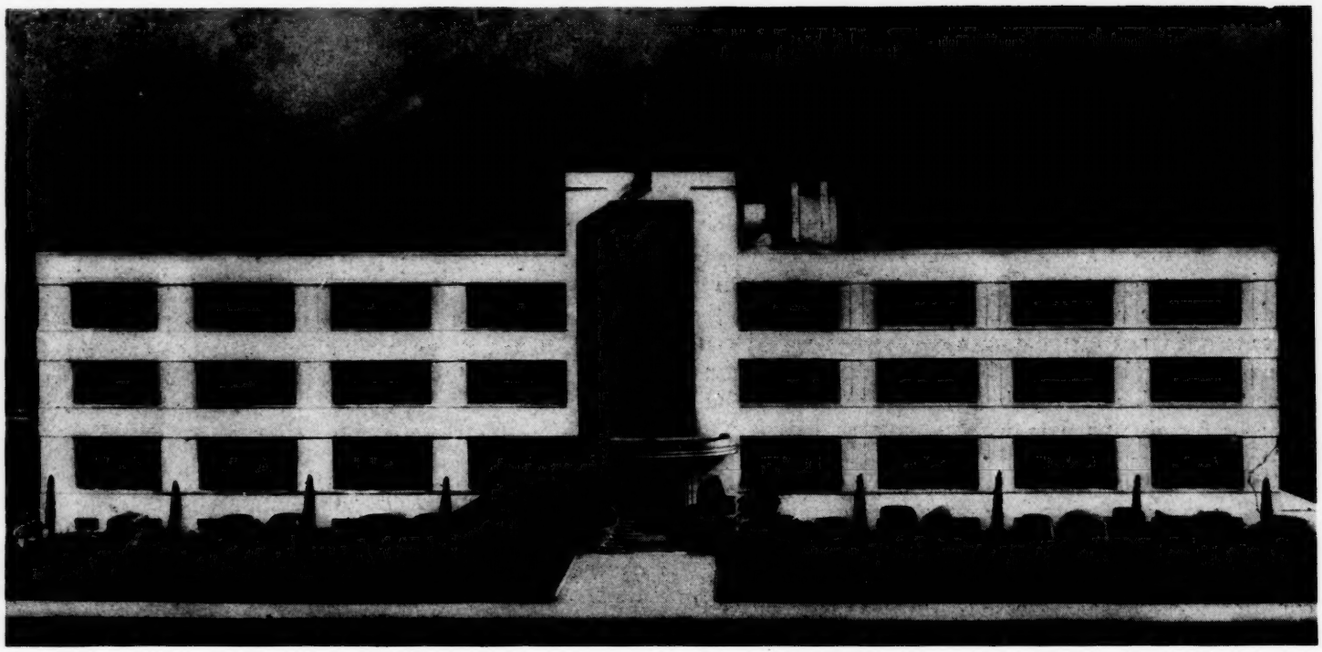


Fig. 13. Ingenious but improper method of venting the end of a steam main, a method which accomplishes nothing.

For such conditions, a 1¼ in. uncovered dry return should almost immediately condense the very slight amount of steam it might contain as pressure lowers, after which the pipe would cool toward the basement air temperature. Thus in about ten minutes half of the heat originally contained within the metal would be dissipated. A wet return in the same time interval will still retain about seven times as much heat as was left in the metal of the dry return pipe. This shows that a wet return will continue to lose heat for a long time after a dry return has cooled, though such loss will be at a very slow rate as the temperature falls, and the burner and pressure may be on again before any appreciable loss has been realized. Consideration of all of these factors proves that during milder weather there must be some slight increase in heat loss of a wet return over that of a dry return, or at least as much, and certainly not less.

In the final analysis, the heat loss of a dry return is greatly decreased if the vent valve is placed just beyond the last radiator connection where it should be, instead of at the end of the return. Steam cannot enter an unvented or air bound return, except possibly for short intervals of time on a vacuumized system whenever pressure is raised, hence there is very little heat for a dry return to give off under such conditions. A wet return below boiler tappings will circulate within itself and lose heat, and if it is above the boiler tappings and without a check valve or safety loop, it will circulate hotter water from the boiler and lose much more heat, particularly so where either the boiler water does not readily cool, as in a non-vacuum system where cooling due to evaporation ceases as soon as atmospheric pressure is reached, or wherever the boiler water is prevented from extreme cooling due to aquastat setting.



The new General Electric Building in Los Angeles.

Electric Heating for Los Angeles Building

In the office and warehouse building here described the heating is the major part of the electrical load, totaling 589 kw. Three types of heating units are used—forced convection wall units, forced convection ceiling units, and calrod units and supply ducts.

THE new General Electric building in Los Angeles represents a centralization of former scattered facilities of the company in that city. It occupies a ground space 215 by 160 ft. It contains 34,400 sq. ft. of area per floor, a total of 104,200 sq. ft. There are 258,000 ft. of electric wire in the structure, designed to make use of 1189 kilowatts of electric power. The connected heating load totals 589 kw., the lighting load 480 kw., and the power load 120 kw.

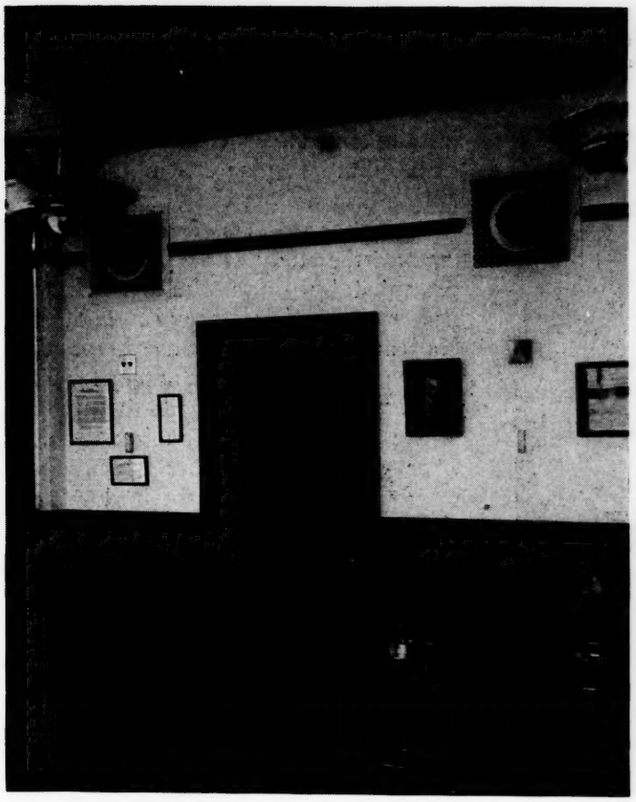
Electrically the building is regarded as one of the show spots of Los Angeles. Automatically controlled heat is one of the features. The heating system actually consists of three different types of heating equipment. The greater portion of the building is heated by forced convection unit heaters mounted high in the walls and partitions of the general offices, private suites, delivery departments and warehouses. The unit which produces the heat is a calrod such as is used in electric ranges, to which have been added radiating fins for facilitating transfer of heat into the air. The motor, totally enclosed, is a sleeve-bearing type. The heat of each unit is distributed throughout the room by means of a built-in fan. Approximately 100 of these heaters are installed in the building. Their sizes range from 2, 3 and 4 kw., with the majority of 4 kw. capacity. They deliver air at a velocity of 710 to 750 ft. per min. and a volume of 200 c.f.m., with a maximum outlet air temperature of 135F.

The air velocity and volume capacity of these heaters made possible an effective method of installation—in the walls, just below the ceiling, rather than near the floor. The units are installed in the walls and partitions on an average of eight feet above floor level. They are 20 inches wide and high, and with a depth of only four inches fit easily into the average wall. An aphonic pressure fan, fitted into each unit in front of the heating coil, sweeps the ceiling of accumulated warm air and circulates it through the room. Temperature curves plotted on this in-the-wall type of heater show a difference of only 1F between ceiling and floor.

Each heater in this battery has its own thermostat control, providing a sort of zone control for the larger rooms. An individual thermostat and hand switch is installed in the wall beneath each of the hundred units. Added control facilities are time switches which automatically turn on and shut off the heat in the morning and at closing time; and thermostatic cutouts which provide automatic protection against overheating.

Installations of this type are finding favor in Southern California among building and plant owners who wish to get away from large central heating units with duct distribution of air. Recent installations completed by the Los Angeles Bureau of Power and Light include a 100 kw. system in an apartment building, a 100 kw. system in the offices of a sea food company, and a 23 kw. installation in an office.

A second type of heating system used in the G.E. building is a 7.5 kw. ceiling unit, forced convection heater. These are mounted from the ceiling in the small package room of the delivery department and in the radio repair room. The heaters are similar in general construction to the wall units of the main heating sys-



(Left) Two electric heaters mounted in an office wall, eight feet above the floor. Individual control switches and thermostats may be seen directly below each heater.

(Above) Interior of a forced convection heater, with grille removed to show fin-type calrod and fan. This is a ¼ kw., 240 volt heater unit. Others in the building are 2 and 3 kw.

tem, but differ in that they are mounted in a steel housing. The units in the two rooms are each connected to one contactor and one thermostat. The individual units deliver 550 cubic feet per minute at a velocity of 900 feet per minute.

The third type of heating employed in the building consists of a system of fin-type calrod units installed in the ducts that supply outside air to the building. Although the structure contains no refrigerated air-conditioning system, many of the interior offices which have no individual heating units are served by a fan system. The blower motors are set up for operation either through the main switchboard or through auxiliary panels near each motor.

The outside air ducts are equipped with eleven heater banks of the calrod fin type. Thermostats installed at the point where the air enters the room from the ducts handle that particular bank of heaters. Protection against overheating is provided by the use of a thermostat in each duct which acts to control temperature if higher heat is being generated than is required, and, in general, serves as a two-way temperature control.

The space saving factor enters into each of the three heating systems used in the building. The entire floor space in every office or room may be utilized. It is estimated that the one hundred wall mounted heaters in this heating system release some 400 sq. ft. of floor space that otherwise would not have been available.

Chemical Dehumidification Valuable to Industry

Direct dehumidification by either solid adsorption or liquid absorption is of greatest value where, (a) it is necessary or desirable to control the humidity in air independently of the dry-bulb temperature, (b) there exists a comparatively large percentage of moisture or latent heat load, (c) it is practical to take advantage of operating economies by using gas fuel or steam in connection with the dehumidifying phase, (d) cold water is available for the cooling phase, according to James C. Patterson, manager of the Dehydration Division, Carrier Corporation, in a paper presented before a meeting of the Metropolitan Section of the American Society of Mechanical Engineers in March.

According to Mr. Patterson dehydration equipment is a necessity in industrial plants where

(a) Conditions to be maintained are below the equivalent of 45 degrees F dewpoint.

(b) Dry-bulb temperatures above 85 degrees F or below 60 degrees F are to be maintained at a relative humidity range of between 10 and 50 per cent.

(c) A fixed relative humidity is required while at the same time permitting variations in dry-bulb temperatures over wide limits.

The speaker listed known industries using dehydration as follows: automatic telephone exchanges, automobile safety glass, cough drops, cupola dry blast, decommissioned ships, drug, engraving and etching, electrical precision products, explosives, film drying, fish drying, gelatine, hard candy, lacquering rooms, leather, libraries, linseed oil drying, lithographing, malt drying, metallic parts, museums, pencil (crayon), plastics, printing, seed storage, shoe, steel, stencil paper, storage warehouses, and testing laboratories.

Economics Featured at District Heat Meet

WITH the resort atmosphere of French Lick Springs, Indiana, as a background, the 31st Annual Meeting of the National District Heating Association held May 14-17 attracted an attendance of over 120 men and women. Officers for the coming year are Fred L. Witsell, president; Leonard S. Phillips, 1st vice-president; John M. Arthur, 2nd vice-president, D. C. Tumbull, 3rd vice-president, and John F. Collins, Jr., secretary-treasurer.

F. L. Witsell

At the opening session on May 14 committee reports were heard including those of the Advisory Committee, J. Earl Seiter, chairman; the Educational Committee, Landis Shaw Smith, chairman; Membership Committee, Joseph M. Barnes, chairman; Operating Statistics Committee, William A. Herr, chairman; and Insurance Rates Committee, J. H. Nickell, chairman.

Afternoon conferences of various interested groups and early morning breakfast sessions were prominent features of the program and during the afternoon of May 14 conferences were held by the Chemistry Committee with E. E. Dubry presiding as chairman and with Louis Shnidman leading the discussion. During this same period a similar conference on Sales Development and Commercial Relations was held with J. C. Butler presiding and with R. D. Martin and N. H. Davidson leading the discussion. Distribution Problems were considered at a conference presided over by W. W. Stevenson with A. A. Sellke leading the discussion. A new feature was a separate conference for the Smaller Companies with A. S. Griswold presiding.

During the evening session on Thursday the meeting listened to the reports of the Rates and Regulations Committee with Russell Hastings as chairman, and to a report of the Meters and Accessories Committee with A. W. Wieters as chairman. Papers were presented as a part of this Committee's work by Richard H. Brown, Henry L. Warhanek, and Charles A. Pohlig.

The morning of the second day was devoted to consideration of Sales Developments and Commercial Relations. During this session A. R. Mumford, Consolidated Edison Company of New York, presented his analysis of the results of the operation of air conditioning systems in four department stores in New York. These stores are of comparable size and characteristics and are located in approximately the same neighborhood. Two of them make use of steam driven refrigeration compressors while the other two are powered by electrically driven motors. Mr. Mumford's analysis indicated that generally the results obtained from these installations were favorable to steam both from the standpoint of revenue accruing into the utility company and also of net cost to the consumer. During the course of his discussion Mr. Mumford made it clear that the operating data as presented applied only to the four installations under consideration, indicating that sweeping conclusions should not be drawn from the data.

One of the features of the entire meeting was the study of heating economics presented by Earle Shultz and J. C. Butler as a joint committee of the National District Heating Association and the National Association of Building Owners and Managers. This Committee had sent questionnaires to operators of a large number of buildings from which they had obtained returns giving pertinent data on the heating costs in nearly a thousand buildings in most of the important cities of the country. When the questionnaire was returned the reports were analyzed statistically and the results reduced to chart and tabular form. The net result of this collection and analysis of operating data is that it probably presents the most comprehensive set of such information which has ever been brought together. Figs. 1, 2 and 3, reproduced herewith, are from this report and indicate some of the important information which can be drawn from such a statistical study.

It will be seen from Figs. 1 and 2 that the unit steam consumption per degree day in office buildings depends not only upon the building volume but also upon the number of hours during the day during which the building is ordinarily heated. Also, it will be noted that the relation between building volume and unit steam consumption is shown by lines which are nearly straight. In referring to Fig. 2 it should be kept in mind that the number of hours per day during which steam is furnished to an office building is not necessarily constant throughout the heating season. It is believed that the hours shown on the chart should be interpreted as hours of normal occupancy of the building. Fig. 3 is similar to Fig. 1 in that it gives the mean line based on the average number of hours per day during which heating service is normally furnished. During the course of presenting his paper Mr. Shultz called attention to the fact that individual buildings within these groups will show steam consumptions which vary considerably from these mean or average lines.

A session on Thursday morning was featured by an address by A. A. Potter, Dean of Engineering, Purdue University, on Trends in Engineering Research. During the same session papers were also presented by the Steam Station Engineering Committee with A. S. Griswold as chairman, by A. W. Wieters, R. C. Hine, A. W. Dierman, R. B. Donworth, R. G. Felger, R. H. McCumber, G. Prestwick, and G. A. Orrok, Jr.

A presentation of material which attracted a great deal of attention was made by Dr. Irving P. Krick, president of Krick Industrial Weather Service, who explained the theory and some of the practices used by his organization in both short term and long term weather forecasting. Dr. Krick illustrated many of

his points by moving pictures and animated charts showing some of the atmospheric conditions present when storms are brewing and when the storm periods are followed by periods of fair weather. Especially interesting was a series of animated diagrams showing the atmospheric conditions which prevailed during the recent flood on the Pacific Coast and so arranged as to illustrate the general theory of weather forecasting.

At a special session held in the afternoon of Thursday, May 16, the entire time was devoted to the report of the Distribution Committee with A. A. Sellke as chairman. Papers included those by V. J. Suche, A. A. Sellke, Paul Chenzoff and William A. Herr, John S. Nelles and A. A. Sellke, and Melvin D. Engle.

The closing session on Friday morning was devoted to reports of the Chemistry Committee under Louis Shnidman, chairman, and a report of the Research Committee, with G. K. Saurwein chairman. Papers presented included: Notes on the Determination of Carbon Dioxide in Condensate, by Thomas J. Finnegan; Some Fundamental Considerations Related to CO_2 Corrosion, by Leo F. Collins; Steam Jet Refrigerating Unit Installations During 1939, by Thomas Ravese; City Water Problems in Air Conditioning, by Richard E. Hull; The Enthalmometer Installation, by Thomas Ravese; Maintenance of Thermostatic Traps on Radiators and Riser Traps, by R. Y. Sigworth; Standardization of the Degree-day, by S. S. Sanford and A. W. Wieters, and Absorption Refrigeration, by W. F. Friend.

Features of the social program included conducted tours of the hotel grounds, informal bridge parties, dancing in the evenings, afternoon outdoor games, and the annual banquet held Thursday evening, during which an honorary membership plaque was presented to Davis S. Boyden. At the banquet also the past President's medal was presented to the retiring president, Glen D. Winans, Detroit.

Golf devotees were active throughout the meeting with the annual men's tournament being held Thursday afternoon. Attractive also in the social program were many informally organized motor trips to surrounding points of interest in southern Indiana including tours through Browne County and visits to the natural limestone caves.

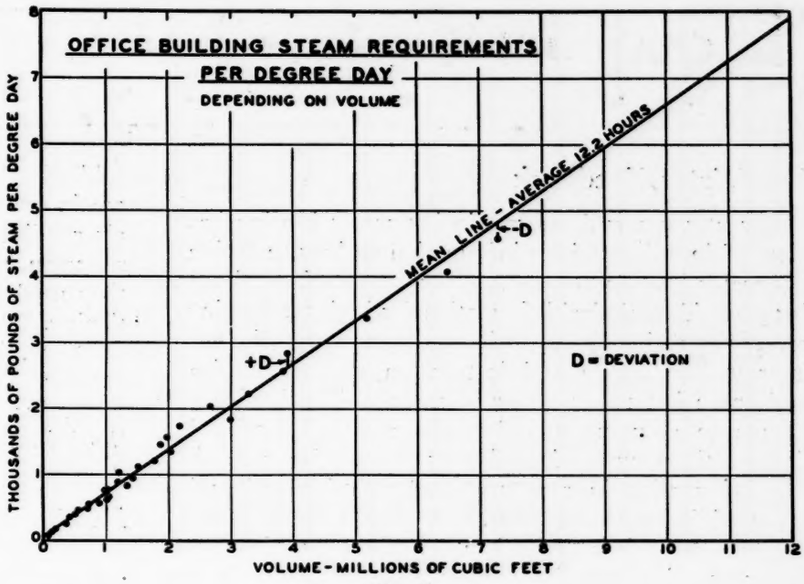


Fig. 1.

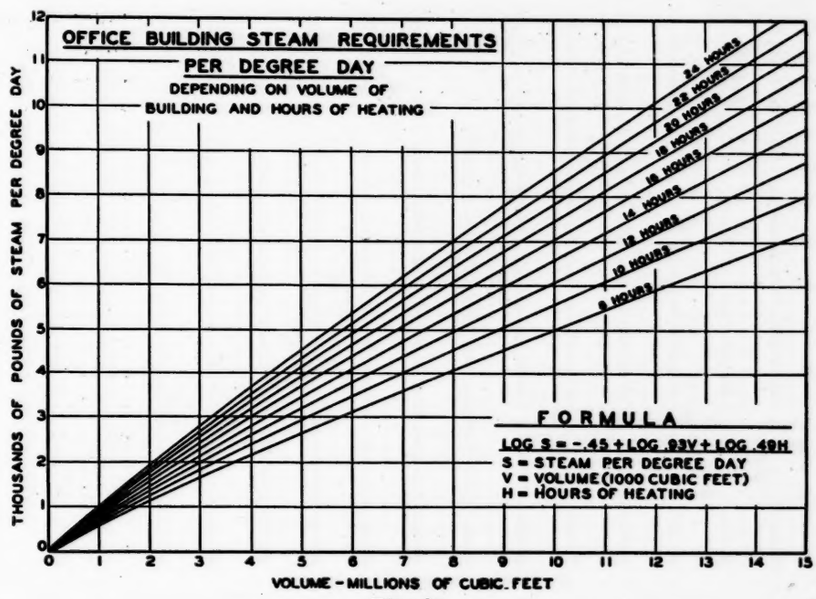


Fig. 2.

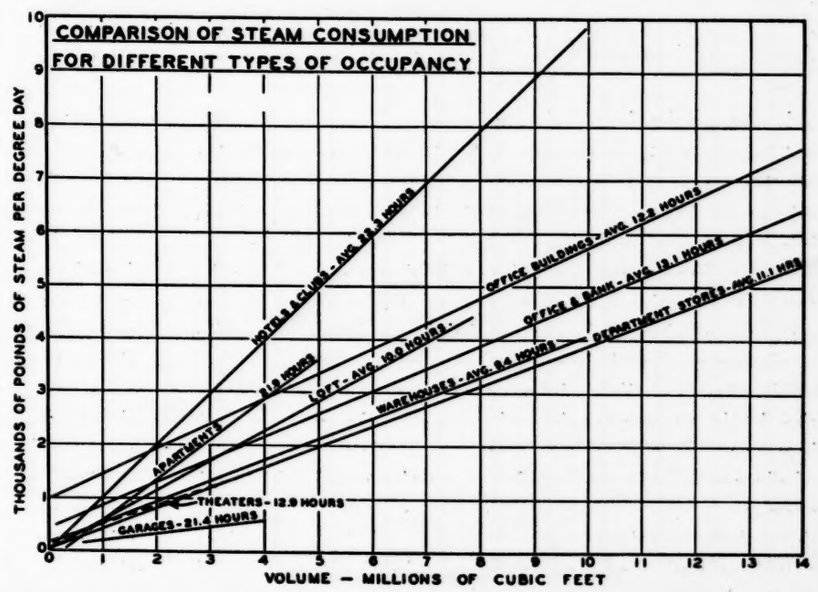

COMPARISON OF STEAM CONSUMPTION
FOR DIFFERENT TYPES OF OCCUPANCY
HOTELS & CLUBS - AVG. 24.1 HOURS
OFFICE BUILDINGS - AVG. 12.2 HOURS
OFFICE & BANK - AVG. 13.1 HOURS
DEPARTMENT STORES - AVG. 11.1 HRS
LOFT - AVG. 10.0 HOURS
WAREHOUSES - AVG. 8.4 HOURS
APARTMENTS
THEATERS - 12.9 HOURS
GARAGES - 21.4 HOURS
THOUSANDS OF POUNDS OF STEAM PER DEGREE DAY
VOLUME - MILLIONS OF CUBIC FEET

Fig. 3.

ABSTRACTS of Current Papers, Books and Pamphlets

Hot Water Handbook

Recently renewed interest in hot water heating has resulted in a demand for information on how to design hot water heating systems. The purpose of this book is to provide technical information for both the heating contractor and salesmen of heating equipment who are interested in design and installation of both service and space hot water heating systems. The book attempts to accumulate under one cover all practical data on these types of heating systems and to publish this information in a manner easily understood and arranged for quick reference.

The handbook is divided into sections covering the major classifications of hot water heating systems. The first section is devoted to service water heating and includes descriptions and various applications of water heaters together with diagrams illustrating good practice. The second section consists of a set of instructions for the proper design and installation for both one and two pipe forced hot water systems. A large number of diagrams are used to illustrate this section. Section three takes up the subject of electrical controls and presents the information in such a way that it can be readily grasped. The fourth section is made up of tables of various kinds of information frequently required and sometimes hard to find elsewhere.

Most of the material in this book is closely tied in with actual equipment and full information is included on the Bell & Gossett line of heating equipment. The book is the best thing which has been brought out on the subject of hot water heating and is to be recommended to all heating men who are interested in this subject. The material is presented in an extremely practical manner and includes much information not easily available from other sources.

[*"B & G Handbook." Published by Bell & Gossett Company, North Chicago, Ill. Flexible cover; 5 x 7¼ in.; 262 pages. Price, $3. Also available through heating equipment wholesalers on a special plan.*]

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Air Conditioning Primer

There have been numerous books written to acquaint the beginner and persons with a slight technical knowledge with the fundamentals of air conditioning. This book differs from earlier books principally in the method of approach. It is the author's purpose throughout the entire book to present the technical information on air conditioning in extremely simple language while at the same time being technically correct.

The book is divided into two parts. Part 1, covers the basic characteristics of heating, air, people and houses which comprise the fundamentals and essentials of air conditioning. Part 2, covers the application and apparatus which comprise the more practical adaptation of the fundamentals of Part 1. A large number of tables and charts are presented in the appendix of the book.

The book is to be recommended to all beginners who are interested in learning something of the subject of air conditioning, including not only students but also salesmen, manufacturers, bankers and others who feel they need some knowledge of the subject of air conditioning.

[*"An Air Conditioning Primer," by William Hull Stangle. Published by the McGraw-Hill Book Company, Inc., 330 West 42nd Street, New York, N. Y. Cloth bound; 6 x 9 in.; 236 pages. Price, $2.50.*]

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Moisture Control in Buildings

In recent years it has become common practice to increase indoor humidities in residences for purposes of better health, greater comfort, and protection of buildings and furnishings. Thus, the control of moisture in residential construction has become quite important and this problem has had the consideration of architects and residential builders. In the early part of 1937, the National Mineral Wool Association in cooperation with the University of Minnesota, started a comprehensive program, the objects of which were first, to determine the extent of condensation within modern buildings and with different methods of operation; second, to measure the effectiveness of different types of construction, and third, to find the limiting conditions under which various types of building designs may be used without excessive condensation and still retain the benefits of air conditioning and good building construction. The test data obtained in these investigations has been used as a basis for the following conclusions:

The problems in residential buildings may be divided into three groups: first, those in which moisture condenses on the room surface of the walls; second, those in which moisture condenses on some interior part of the walls; and third, those which are encountered in cold attics and similar places. There are usually several factors entering into each of these problems and a solution may lie either in a change in building construction or in modification of operating conditions.

Wall surface condensation problems can usually be solved by adding sufficient insulation to raise the room surface temperatures above the dew-point temperature of the inside air. If conditions are too severe to be met by the addition of insulation, then it is necessary to consider methods of reducing the dew-point temperature of the inside air. If the outside walls of a residence are well insulated, condensation will occur on the room surface of the windows (even with storm windows) before any trouble would be experienced with wall surfaces.

Condensation within the interior parts of a wall may be prevented by using a type of construction which will prevent the vapor from entering the warm side of the wall. Conditions may often be improved by using a type of construction which will allow the vapor to

pass freely through the outer section of the wall. There are several materials now on the market made either in the form of a membrane or as an integral part of the plaster base, or as a surface finish for the plaster, which have a high resistance to the passage of vapor and may be used on the warm side of the wall to effectively stop vapor from entering the wall. There are other materials such as good building papers which are weatherproof but not vapor proof, and which are well adapted for use on the cold side of the wall. It is possible and practical to construct a wall that will prevent the passage of vapor under any reasonable humidity conditions that may be imposed on its warm surface.

The use of a good vapor barrier underneath the plaster does not affect the drying-out process of the plaster. Regardless of whether or not a vapor barrier is used it is essential that a building be thoroughly ventilated during the drying-out period of the plaster. Many condensation problems are due to lack of ventilation during this period of construction.

The investigations thus far made in regard to attic ventilation have been made with small scale construction. It is evident from data taken that sufficient ventilation may often be used in cold attics to eliminate condensation difficulties without materially adding to the heat loss from the buildings. For effective ventilation the openings to the outside must be arranged to give reasonable circulation of outside air to all parts of the attic.

Operating conditions within a building are a vital factor in most condensation problems, and when condensation occurs in a residence after the plaster has been thoroughly dried out one of the most common causes is that of high relative humidities carried within the building. For a given type of construction the maximum allowable inside relative humidities must be reduced as the outside temperature drops. Unfortunately some of the present day humidifying equipment is so operated that the relative humidity is increased rather than decreased during cold periods.

[*"Methods of Moisture Control and their Application to Building Construction," by Frank B. Rowley, Axel B. Algren and Clarence E. Lund. Bulletin No. 17, Engineering Experiment Station, University of Minnesota, Minneapolis, Minn. Paper cover; 57 pages; 6 x 9 in. For copies address Frank B. Rowley, Director of Engineering Experiment Station.*]

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Dust Explosions

Dust explosions have been responsible for a series of disasters involving large loss of life and property extending over a period of years. The extended list of these explosions printed at the end of this book is impressive evidence of the seriousness of the hazard. The United States Census of Manufacturers shows that at least 28,000 industrial plants employing well over 1,000,000 persons, and manufacturing products having an annual value in excess of $10 billion are subject to the hazard of dust explosions.

During the World War the prevention of dust explosion first received intensive attention. In July, 1922, the National Fire Protection Association organized the present committee on dust explosion hazards which since has been working with both the government and industry to prepare practical codes to indicate necessary measures to secure reasonable safety to life and property from dust explosions and fires.

This book contains the codes which have been developed so far by this committee and which have been adopted by the Association. The first part of the book is devoted to discussion of the fundamental principles for the prevention of dust explosions in industrial plants while the remainder of the book is made up of the various codes. These codes cover the following types of plants: aluminum bronze powder; coal pneumatic cleaning plants; flour and feed mills; pulverized fuel systems; spice grinding plants; starch factories; sugar and cocoa; terminal grain elevators; wood flour manufacturing establishments and woodworking plants.

The last code in the book is one for use of inert gases for fire and explosion prevention. The book ends with a detailed record of dust explosions in the United States.

[*"National Fire Codes for the Prevention of Dust Explosions, 1940," published by the National Fire Protection Association, 60 Batterymarch Street, Boston, Mass. Paper cover; 6 x 9 in.; 135 pages. Price, 75 cents. Copies available from the American Standards Association, 29 West 39th Street, New York, N. Y., or National Fire Protection Association.*]

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Air Conditioning for Hay Fever Relief

During the winter months, December to February, the pollen of cedars causes many cases of hay fever in Texas. In the hope of finding a method of relief for the sufferers, the University of Texas Bureau of Engineering Research conducted an investigation to determine whether or not it would be possible to provide a pollen-free atmosphere in rooms by using air conditioning equipment. In this bulletin, there is presented a discussion of the cedar-pollen hay fever problem, and the results of the investigation conducted by the University of Texas. Information is presented on a simple, low cost air conditioning unit that was developed as a result of this work.

[*"Air Conditioning for the Relief of Cedar-Pollen Hay Fever," by Alvin H. Willis and Howard E. Degler. Published by the University of Texas, Engineering Research Series No. 31, Bureau of Engineering Research, Austin, Texas. Paper cover; 48 pages; 6 x 9 in. A limited number of copies are available for free distribution.*]

BRIEF REVIEWS

BOILERS. The source of copper deposits in boilers is generally attributed to surface condensers and closed heaters. The question as to whether such copper losses are caused by the presence of ammonia or other ions is discussed in the light of data collected from a number of plants, as given in the tables. Suggestions are made as to means of preventing, as far as possible, these copper losses in condensers and heaters. [*"Influence of Copper with Respect to Corrosion in Boilers," by F. R. Owens. Published in Combustion, 200 Madison Avenue, New York, N. Y., May 1940, pages 41 to 44. Price, single copies, 25 cents.*]

NEWS OF THE MONTH

Contractors Association Continues Drive for A.C. Business; Standards Committee Studies Compressor Ratings

NEW YORK—The importance of the small home market to the heating contractor, a market estimated to amount to $120,000,000, was called to the attention of the members of the Heating, Piping and Air Conditioning Contractors National Association, assembled here for the 51st annual convention of the Association, May 27-29. The importance of this market was revealed by Joseph C. Fitts, national secretary of the Association, in his report to the Association. Mr. Fitts also pointed out another good field for contractor activity, that of modernization.

In the report of the Committee on Air Conditioning, J. Lawrence DeNeille, St. Louis, chairman of the Committee, stated that the period of pioneering and missionary selling in air conditioning was about over and that the selling and installing of air conditioning is beginning to be recognized as a contractor's problem. This Committee made the following recommendations:

1. That where consulting engineers write complete specifications and provide plans sufficiently in detail for intelligent bidding, such air conditioning installations are entirely within the province of the work of our members.

2. That the members of our Association educate themselves on the marketing, engineering, installation and servicing of air conditioning installations.

3. That each one so educating himself provide an organization with the necessary technical assistance, including salesmen, engineers, superintendents and servicemen. (This depends upon local conditions. Contractors should watch carefully not to overbuild their organizations.)

4. That the members of our Association refuse to accept the responsibility of making good on performance guarantees unless the member has checked the plans and specifications and ascertains from his own technical knowledge and experience that the equipment and installation on which he is estimating are adequate to perform the requirements of the guarantee.

5. That until our members so inform themselves that they can relieve the manufacturer of having franchized distributors, it may be expected that the manufacturer will protect his own interest by such a procedure and that it is incumbent upon our members to so inform themselves that they may buy equipment in the open market from any manufacturer for the purpose of fulfilling their contracts.

In addition to the above recommendations made to the Association, the Committee recommended the following points for consideration by all of the heating and air conditioning industry:

1. That the contractors do reaffirm the position of this National Association that the Heating Contractor is the logical final outlet for air conditioning material and apparatus and should be recognized as such.

2. That the Heating Contractor should be enabled to buy and quote on any make of apparatus or material he chooses, naming in his main bid the product upon which it is based and quoting alternates on other equipment.

3. That the contractors and manufacturers cooperate to obtain the adoption of safety codes which will produce adequate safety requirements with minimum installation expense.

4. That a conference be arranged for the study of rating capacities of apparatus and an agreement be reached as to the factor of safety to be applied to such ratings.

Certain problems have to do mainly with the contractor and the manufacturer and the Committee suggested that heating contractors should request the manufacturers to work on the following problems:

1. That the manufacturers adopt and use a Uniform Warranty.

2. That the manufacturers be asked to study their responsibilities to their contracting trade in relation to manufacturers' sales to so-called national users under the Robinson-Patman Act.

3. That the manufacturers should study what can be done to establish and maintain the resale value of their products in all those states where resale price maintenance laws have been adopted.

The new I-B-R cast iron boiler ratings were discussed in the report of the Committee on Boiler Output, of which Harry M. Hart, Chicago, is chairman. Mr. Hart pointed out that I-B-R net load recommendations are in most cases higher than the Committee's previously published ratings, due partly to the fact that the Institute's recommendations are based on 13,000 B.t.u. coal, and also to the fact that the Committee felt it necessary to be on the conservative side. After having the actual test data before it the Committee stated that it was now in a position to accept the manufacturers' recommendations with a much more certain degree of confidence.

In this connection, the Committee emphasized that it has never believed it to be bad practice to sell a boiler somewhat over sized, especially due to the fact that the original design load is seldom decreased but frequently increased after the original installation.

The Committee also called the attention of the members to the fact that the net load ratings in the I-B-R recommendations are based on 13,000 B.t.u. coal and suggested that each local group of contractors decide for itself the grade and heat value of the coal used in its vicinity and convert the ratings accordingly.

Refrigeration compressor ratings are being studied by its Committee on Standards, the Association was told. This committee, of which George P. Nachman, Cleveland, is chairman, called attention to the revised and enlarged Third Edition of the Association's Engineering Standards, printed last year, and to the favorable comment received on the table on "Classification of Insulation Materials," which the Committee claims is one of the few complete surveys made of the relative value of practically all insulating materials.

The Committee proposed that the ASHVE be requested to extend its convector testing code so that tests will be required with convector temperatures down to 120F for hot water.

A joint committee of the Association and the Institute of Boiler and Radiator Manufacturers has been set up to write specifications for heating a small home with radiator heat, with the purpose of having this approved by FHA, according to a report of the Committee on Trade Promotion, of which E. P. Ambler, St. Louis, is chairman. This joint committee, in addition, proposes to develop a plan for putting selling helps for radiator heating in the hands of manufacturers' representatives, jobbers' salesmen, and contractors, as well as carry on other trade promotion activities. Finally, a joint committee has been provided for on design, with the objective of creating a small compact unit for small house work.

The convention also heard reports by the Committee on Welding, the Committee on Membership, the Committee on Apprenticeship and the Committee on Certification, and a report on the Plumbing and Heating Industries Bureau.

J. E. McNevin, Denver, was elected president of the Association. Others elected were Arthur F. Nass, Pittsburgh, vice president; S. Austin Pope, Chicago, treasurer; and Joseph C. Fitts, New York, secretary.

At the closing session, held in the Hall of Special Events at the World's Fair, research and sales methods were discussed.

Gas Furnace Ordinance Considered

LOS ANGELES—Action toward the adoption of an adequate warm air furnace heating ordinance for Southern California cities, towns and counties was taken at a meeting of manufacturers and distributors of gas heating appliances, representatives of the Heating and Ventilating Division of the Los Angeles Department of Building and Safety, and gas utility men here May 15.

The consensus at the meeting was that adequate ordinance requirements relative to proper sizing are essential to prevent the widespread practice of overfiring gas heating appliances, which results from installation of undersized equipment. The heating trade, generally, concurred in the belief that such a sizing code is highly desirable. The meeting disclosed that many have felt that sizing requirements based upon exact B.t.u. heat loss calculations were too complicated and involved to be practical for use as an ordinance requirement. The revised section on sizing contained in the revised code and presented for discussion on May 15, together with charts and calculating sheets, eliminated much objection against former sizing proposals.

The proposed ordinance, which it is planned to offer to Southern California communities for "adoption by reference," is patterned largely after the Los Angeles city gas heating ordinance. Revisions from the sections submitted last fall and variances from the Los Angeles code pertain mainly to the size of heating appliances, which, under the proposed code, would be based on the size of the room served by the appliance. The Los Angeles city code specifies that the furnace input must be eight times the cubical content of the room. Provisions of the proposed code would base input of furnaces on actual heat loss data.

The above points, and some other minor matters on which agreement has not yet been reached, remain to be adjusted at subsequent meetings to be held in June and July, when it is hoped to arrive at a standard code suitable for adoption by various Southern California municipalities.

1940 A.C. in N.Y. Totals 9159 Hp.

NEW YORK—According to reports by the Consolidated Edison Company of New York, Inc., 215 air conditioning installations, totaling 7916 hp., were connected to the company's lines in Manhattan during the first four months of 1940. The same utility reports 14 installations totaling 461 hp. in the Bronx; 33 installations totaling 395 hp. in Brooklyn; and 18 installations totaling 387 hp. in Queens for the same four months.

Build Test House at Propeller Plant

HARTFORD—A new test house, specially designed for airplane propeller testing, containing the largest facilities in the world for propeller testing, has recently been completed by the Hamilton Standard Propellers Division of the United Aircraft Corporation. It covers approximately 13,800 square feet and includes four propeller test chambers, enabling the testing of propellers for engines up to 5,000 horsepower.

In order that engine cooling may be controlled independently of air furnished by the propeller, a metal engine shroud is provided for each test stand. Completely enclosing the engine, the shroud is connected by a duct to a blower room beneath the test chamber. Here air drawn from the forward part of each chamber is "boosted" by two 150 hp. fans and directed directly to the shrouds. Delivering 55,000 c.f.m., each fan can supply air to two chambers in sufficient quantities to cool the cylinders of engines running simultaneously in both.

A system of signal lights at each control board shows whether sufficient air for cooling is reaching the engine shroud and if the rolling steel curtains at the ends of the exhaust and intake stacks are up or down. If insufficient air is reaching an engine, an automatic cutout switch will shut it off, regardless of the engine operating conditions at the time.

Like the intake stack, the exhaust stack is horizontal and has soundproofing vertical baffles extending along its 24 feet from floor to ceiling. The layer-like arrangement of the baffles also helps to straighten out the air flow, the air attaining a velocity of 100 miles an hour under certain test conditions. The control rooms are also soundproofed and semi-air conditioned.

A.C. Market Impresses Gas Industry

CHICAGO—Realizing the potential market for gas in air conditioning, the executive conference of the American Gas Association meeting here May 24, passed the following resolution:

Resolved, that the executive conference goes on record to urgently bring to the attention of the executives of the industry the importance of the potential gas air conditioning load, in the belief that the major problems of invention and production have been solved, and that a wide field is open for close and progressive cooperation between gas utilities and equipment manufacturers through conference, education and promotional efforts, to attain highly desirable and profitable additional business.

Lincoln Addresses Boston Group

BOSTON — Massachusetts chapter, ASHVE, met at the Harvard School of Public Health May 21 for the regular monthly dinner meeting. At a business meeting prior to the speaking, Walter Barnes, Amos Bartlett and J. W. Brunton were elected to the board of governors. They in turn elected Professor C. P. Yaglou as president, Amos Bartlett vice president, and Professor Peerson as secretary-treasurer.

Roland Lincoln, manager of the Dust Laboratory of the B. F. Sturtevant Co., was the guest speaker, on the subject of "Dust and Fly-Ash Removal from Stacks of Boiler Plants," in which he gave the results of laboratory and field tests and on the selection of equipment. He illustrated his talk with slides.

The second subject on the evening's program was an open discussion on the question whether "Massachusetts chapter should sponsor minimum requirements for heating and air conditioning in this vicinity." It was finally voted that the incoming president should appoint a committee of five to consider the matter further and report at the next meeting, perhaps drawing up a minimum of standards for members of the air conditioning industry in Massachusetts. This committee is to consist of one consulting engineer and representatives of the principal equipment makers. This subject of a set of standards is also being considered by a committee of the Air Conditioning Bureau, appointed some months ago.

Phila. Chapter Elects Eastman

PHILADELPHIA — The Philadelphia chapter of the ASHVE held its final meeting of the season on May 9 at the Huntingdon Valley Country Club. This was the annual golf outing of the chapter, the only business transacted being the installation of the new officers for the year 1940-1941. Newly elected officers are: president, Carl B. Eastman; first vice-president, H. Berkley Hedges; second vice-president, Harry H. Mather; treasurer, Edwin Elliott; secretary, Arthur O. Caldwell; member of the Board of Governors, L. E. Moody.

The Philadelphia Section of the ASRE closed its season with the annual members meeting held at the Penn Athletic Club on May 3. Newly elected officers for the season of 1940-1941, are L. C. Leslie, Johns-Manville, chairman; R. B. Davis, first vice-chairman; R. J. Thompson, second vice-chairman, and A. B. Chamberlain, secretary-treasurer.

The Philadelphia section of the ASME elected Lee P. Hynes as chairman for the coming year.

Centrifugal Fans Standardized by Fan Makers Association

DETROIT—A program of fan standardization effective in the early part of 1941 has been adopted by the National Association of Fan Manufacturers, it was announced May 10. It is contemplated that this action will bring the advantages of industry standardization to all users of fans.

The program adopted includes the following essential points:

1. The scope of standardization covers those types of centrifugal fans designed for application in, and furnished under specifications for, the heating, ventilating and air conditioning fields.

2. To serve the range of field applications, standards were established for 25 sizes of fans by setting up a series of maximum wheel diameters between the limits of 1 ft. to 11 ft. and their corresponding maximum outlet areas for both single width and double width types. The series was based on the preferred number system advocated by the American Standards Association. Individual design or patented features will be in no way restricted and the fan designers' opportunity for development of high efficiencies remains ample.

The entire program of standardization was approved to become effective the early part of 1941.

Membership of the Association includes the following fan manufacturers: American Blower Corporation, Autovent Fan and Blower Company, Bayley Blower Company, Buffalo Forge Company, Clarage Fan Company, Garden City Fan Company, The Green Fuel Economizer Co., Inc., Ilg Electric Ventilating Company, The New York Blower Company and B. F. Sturtevant Company.

Blast Coil Manufacturers Organize

DETROIT—The Blast Coil Manufacturers' Institute was formed by executives of companies manufacturing blast coils at a meeting here April 11. The conference was preceded by a meeting of engineers connected with these manufacturers who met for the purpose of discussing and considering a standardized method for testing and rating their product. The primary purpose of the new Institute will be to develop and establish a standard method for testing and rating blast coils for heating and cooling.

Officers of the new Association, elected at the meeting, are: president, R. J. Resch, McQuay, Inc., Minneapolis; vice-president, R. M. Stikeleather, B. F. Sturtevant Co., Boston; secretary-treasurer, M. F. May, Young Radiator Co., Racine, Wis.

ASHVE Announces Meeting Plans

WASHINGTON—This city will be host to the ASHVE at its 1940 summer meeting, to be held June 17-19 at the Wardman Park Hotel. A worthwhile program has been announced by the committee on arrangements.

Extensive plans have been completed for the men in the way of entertainment, and arrangements have been made for fishing on Chesapeake Bay, golfing at the Congressional Country Club, sightseeing trips, as well as inspection trips of unusual interest. These will include the David W. Taylor Model Basin at Carderock, Md., the Central Heating Plant which produces steam for heating government buildings, and the group of Capitol Buildings, including the 5,000 ton refrigeration plant.

The technical program follows:

JUNE 17—A.M.

Summer Cooling Load as Affected by Heat Gain Through Dry Sprinkled and Water Covered Roofs, by F. C. Houghten, H. T. Olson, and Carl Gutberlet.

The Problems of the Psychrometer, Historical Resume, by H. B. Nottage and L. M. K. Boelter.

JUNE 18—A.M.

Study of Changes in Temperature and Water Vapor Content of Respired Air in the Nasal Cavity, by L. E. Seeley.

Summer Cooling Requirements of 745 Clerks in an Office Building, by Dr. W. J. McConnell and M. Spiegelman.

Fever Therapy Locally Induced by Conditioned Air, by Dr. M. B. Ferderber, F. C. Houghten and Carl Gutberlet.

JUNE 19—A.M.

Effect of Room Dimensions on the Performance of Direct Radiators and Convectors, by A. P. Kratz, M. K. Fahnestock, E. L. Broderick and S. Sachs.

Air Flow Through Supply and Exhaust Openings in Buildings, by G. L. Tuve and D. K. Wright, Jr.

Boeschenstein Honored by Illinois

TOLEDO—Harold Boeschenstein, president of Owens-Corning Fiberglas Corporation, Toledo and Newark, Ohio, has been chosen an outstanding alumnus of the College of Commerce and Business Administration of the University of Illinois. Announcement of the honor to Mr. Boeschenstein, who graduated from the University in 1920, has just been received from Charles M. Thompson, dean of the College of Commerce of the University.

Mr. Boeschenstein has given the leadership to the development of glass in thread-like fiber form which has many insulating and other uses in industry and which has materially aided human comfort.

Dean Thompson announced that beginning this year, the College of Commerce of the University of Illinois is honoring each year three of its outstanding alumni. Mr. Boeschenstein is one of the three chosen for 1940.

Myrick and Engle Are Speakers at Boston Bureau Meeting

BOSTON—Members of the Air Conditioning Bureau held their regular monthly dinner meeting April 30 at the Hotel Bradford, with Lt.-Col. James W. H. Myrick and M. D. Engle as the guest speakers. Col. Myrick, who is Director of Smoke Inspection, Massachusetts State Department of Public Utilities, gave a comprehensive outline of the "operation of the Smoke Abatement Division," and Mr. Engle, Boston Edison Company, spoke on the "Engineering Aspects of Air Pollution Control."

Col. Myrick declared that "Boston is the cleanest city of any of comparable population in the world. The Smoke Abatement Division has ten inspectors and a chief inspector constantly at work in the 28 cities and towns of its district, these towns paying for the support of the division according to the amount of their taxes.

"Inspections run over 300,000 a year, with less than one-half of one per cent of violations of the smoke law. In Pittsburgh there are 150,000 stacks outside the authority and control of the smoke abatement division, but in Boston all stacks are under control of the state department. Eighty per cent of all violations of the smoke law are from homes and small apartment houses. This is true all over the country, and is due to old equipment and the use of soft coal, generally of high volatility, in small combustion chambers and ignorance of how to properly handle fires on the part of janitors, who generally also have other duties to perform which take them away from their fires.

"It is the policy of the Massachusetts Smoke Abatement Division to co-operate with janitors and firemen and teach them how to burn this soft coal, which, though higher in price, is better quality than that used in most cities, especially those of the Mid-West. Inspectors educate these people that smoke means waste of fuel which can be avoided by properly handled fires. Most of the smoke trouble is due to lack of oxygen—in other words incorrect use of drafts to burn the coal and keep down the smoke. Six minutes is the extent of time that a smoke column is permitted to issue thickly from a stack before an inspector gets on the telephone or hops out to interview the offending fireman. Very few of the big industrial concerns and utilities are among the offenders, for they have firemen constantly on duty, smoke alarms and smoke removers equipping their stacks. During the recent cold period in this part of the country, fuel consumption was 12½% above normal."

WALLS OF ONE MATERIAL

		CONSTRUCTION NO. (ON H. & V.'s REFERENCE DATA SHEET 71 OR 72)	WALL THICKNESS	FACING	HOURS OF SUN: 8 AM	10	12 NOON	2 PM	4	6	8	10	12
					WHEN TEMPERATURE DIFFERENCE GIVEN BELOW IS MULTIPLIED BY THE OVERALL COEFFICIENT, U, THE PRODUCT IS THE ACTUAL RATE OF HEAT FLOW TO INDOOR AIR, IN B.T.U. PER HR. SQ. FT.								
PLAIN BRICK MASONRY WALLS	NO PLASTER ON WALLS	1A	4"	N*	2	4	7	10	12	13	13	11	9
				E	20	29	29	27	25	23	19	15	14
				S	3	8	16	22	24	23	20	17	13
				W	4	5	10	20	33	39	34	28	22
		2A	8"	N*	5	4	4	5	7	9	10	11	10
				E	8	11	16	19	19	18	17	16	15
				S	7	6	7	10	15	17	17	17	16
				W	9	7	6	7	11	18	23	24	21
		3A	12"	N*	7	8	9	9	9	9	8	7	6
				E	11	11	13	16	18	18	18	14	13
				S	10	10	11	12	12	13	14	13	11
				W	13	13	13	13	13	13	14	15	16
STONE WALLS	WALLS ARE WITHOUT PLASTER	9A	8"	N*	4	4	4	6	8	10	11	11	11
				E	9	13	17	17	17	17	16	15	13
				S	5	5	7	11	15	18	19	15	14
				W	7	6	5	8	13	19	23	21	19
		10A	12"	N*	7	6	5	5	6	7	8	9	10
				E	9	9	10	12	13	14	14	13	13
				S	9	8	8	7	9	11	13	13	14
				W	11	9	8	7	8	10	14	17	17
CONCRETE WALLS	PLAIN WALLS; NO PLASTER		2"	N*	4	9	12	15	15	14	11	8	4
				E	28	33	32	30	30	21	16	10	6
				S	9	18	24	26	24	20	16	11	6
				W	4	10	21	35	40	38	28	21	14
			4"	N*	3	6	9	14	14	14	12	10	7
				E	23	26	26	27	23	20	16	12	8
				S	4	11	19	24	23	20	17	13	8
				W	4	7	14	28	35	35	29	23	16
		13A	8"	N*	2	3	6	8	11	12	12	12	10
				E	11	18	20	21	20	19	17	15	11
				S	3	5	11	16	19	19	18	16	13
				W	5	5	7	14	23	28	27	23	19
			12"	N*	5	4	4	5	7	9	11	11	10
				E	7	10	14	16	16	16	16	15	13
				S	6	5	6	10	14	16	16	15	14
				W	7	6	5	7	12	19	22	21	19
		15A	16"	N*	7	6	5	5	6	7	9	10	10
				E	9	8	10	13	14	14	14	14	14
				S	8	7	7	8	10	12	13	14	14
				W	10	9	9	7	8	11	15	16	17
		16A	20"	N*	8	7	6	6	5	6	7	8	8
				E	11	10	10	12	12	13	13	13	13
				S	10	9	8	8	8	9	10	12	12
				W	13	12	11	10	9	10	11	14	16

* USE ALSO FOR SHADE

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HEAT FLOW THROUGH SUNLIT WALLS OF ONE MATERIAL

The table on the other side of this sheet, prepared by C. O. Mackey and L. T. Wright, Jr., based on a method outlined in the March and April 1940 issues of HEATING & VENTILATING, can be applied for finding the amount of heat flowing through certain simple walls of one material at various hours of the day. The table is based on a value of 4 B.t.u. per hr. sq. ft. deg. F for the outside air film coefficient and consequently, when used with the overall coefficients given in HEATING & VENTILATING's Reference Data 79, the calculated cooling loads are on the safe side.

The table is calculated for a North latitude of 40 degrees but it is believed that the effect of latitude for any city in the United States is slight and probably less than 3%. The table is also calculated on an indoor D.B. temperature of 80F. If another indoor dry bulb air temperature, t', is used, add (80—t') to the temperature differentials given in the table on the other side.

It should also be noted that the table is calculated for a typical design day in mid-July in which the outside D.B. temperatures vary from hour to hour, as shown in Fig. 1 below.

It is believed that the table with its rational basis should give the combined contribution of air temperature difference and sun effect to the cooling load at any hour of the design day.

Similar tables for certain Wood Frame Walls will be found in HEATING & VENTILATING's Reference Data No. 177-178, and for certain Roof Constructions, in HEATING & VENTILATING's Reference Data No. 179-180.

Attention is also called to the data given in HEATING & VENTILATING's Reference Data No. 83-84 in which a method of estimating the sun effect on walls is presented. The data given in this sheet, to some extent, supersedes the information given there.

Example: What is the heat load at 4 p.m. and 6 p.m. on a typical sunny July day due to sun heat and air temperature difference on the walls of a building of plain brick masonry 12-in. thick without plaster? The net wall areas are as follows: north and south walls, 20,000 sq. ft.; east and west walls, 10,000 sq. ft.

SOLUTION: The wall construction designated is 3A in HEATING & VENTILATING's Reference Data 79-80 and the value of the coefficient U is 0.31 B.t.u. per hr. per sq. ft. Examination of the accompanying table shows that the rate of heat flow to the indoor air at 4 p.m. and 6 p.m. is as follows:

	4 P.M.	6 P.M.
North Wall.....	20,000 × 0.31 × 9 = 55,800	20,000 × 0.31 × 9 = 55,800
South Wall.....	20,000 × 0.31 × 18 = 111,600	20,000 × 0.31 × 18 = 111,600
East Wall.....	10,000 × 0.31 × 12 = 74,400	10,000 × 0.31 × 13 = 80,600
West Wall.....	10,000 × 0.31 × 13 = 80,600	10,000 × 0.31 × 13 = 80,600
TOTAL.....	B.t.u. per hour = 322,400	328,600

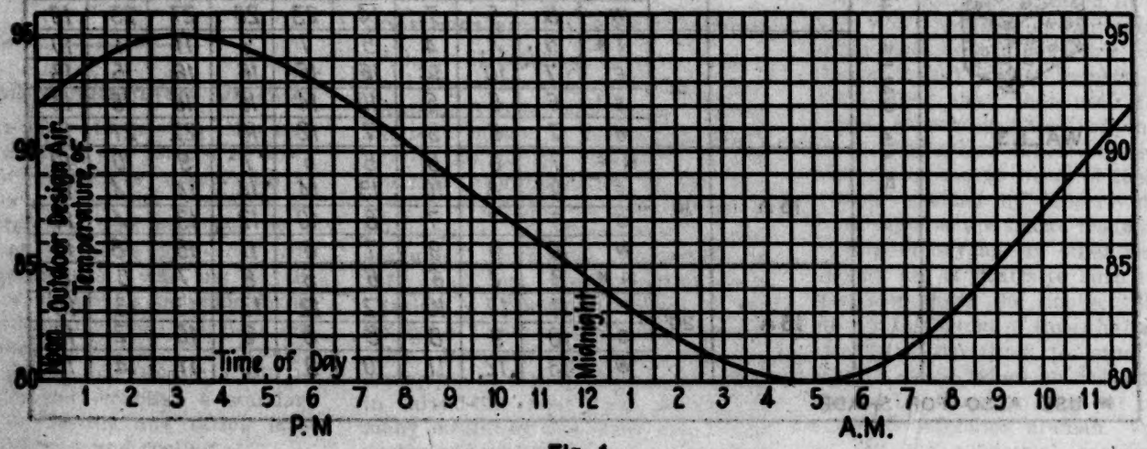

Fig. 1.

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H. & V.'s REFERENCE DATA—176

Buffalo A.C. Council Launches 3-Point Promotional Program; Will Sponsor Prize Contest, Publish Weather Data

BUFFALO — The Air Conditioning Council of Western New York has launched an extensive three-cornered program to promote the sale of air conditioning equipment in this area, according to Walter P. Davis, executive secretary of the Council.

The first phase of the program is concerned with selling the Buffalo public on the idea that the temperature they have to live in during the hot summer months is considerably higher than that reported by the weather bureau from its skyscraper perch here where the cool breezes of Lake Erie blow.

"For years we have been trying to acquaint the public with the idea that it is not primarily the outside temperature, but the inside temperature that we are concerned with," Mr. Davis said. Buffalo, he pointed out, has always had a rather high relative humidity and this makes it uncomfortable during the summer time despite the fact that the thermometer reading is not particularly high when compared with other cities.

"But inside stores and other places of business," he said, "where lighting and display of merchandise raise the temperature, it is considerably warmer than out in the street. Coupled with high relative humidity, the condition becomes almost unbearable."

Mr. Davis said many merchandising institutions and factories here are branches of national concerns with headquarters in other cities. Executives of these firms gather their impressions of Buffalo's weather conditions by a study of the weather reports. They naturally get the idea that because the temperatures in Buffalo are relatively low, there isn't much need for air conditioning here, Mr. Davis declared. But they don't get a picture of the relative humidity and when local managers ask for air conditioning these executives usually turn thumbs down on the idea.

This year the Council plans to set up a temperature and relative humidity reading unit in the heart of the downtown area so the public can get a daily reading of the kind of atmosphere they are actually living and working in compared to the reports from the skyscraper recorder.

These special readings also will be published daily in the local newspapers or announced over radio stations. Mr. Davis said this should cause people to think more about air conditioning and the need for it.

The second point in the Council's program is a promotion campaign in which the Council's official seal will be placed in a visible manner on every store and institution which is air-conditioned. To make the public more conscious of air conditioned buildings, the Council is sponsoring a contest. Prizes will be awarded to those making the most complete reports of the number of air conditioned buildings in the city, the names of the stores, the nature of their business, etc.

Mr. Davis believes this also will serve the purpose of awakening store owners to the need of air conditioning for competitive purposes as well as acting as an educational medium for the general public.

The third phase of the Council's program is the preparation of a series of promotional booklets to foster the idea of summer air conditioning. In past years the Western New York Council has distributed these booklets only in the Western New York area.

But this year a national distribution is being arranged through utility companies throughout the country, Mr. Davis said. Because no utility's territory overlaps another utility, there will be no duplication of promotional effort with these booklets.

The booklets will show photographs of installations of air conditioning equipment in various types of businesses which might apply to any section of the country. This marks the first time such a national drive has been undertaken in the air conditioning field.

Looking back over the work of the Western New York Council during the past year, Mr. Davis said that the new policy of inviting prospective customers to Council meetings has worked out very satisfactorily and probably will be pursued during the coming year. The Council had a very progressive year and now has 61 members. The number of dealers in this area remained about the same.

Plans already are under way for next year's meetings, of which there will be seven.

To Discuss Effect of A.C. on Water

LOS ANGELES—The Twelfth Annual Session of the Institute of Government, to be held at the University of Southern California, June 10-14, will present the subject of air conditioning in one of the principal addresses and in open forum discussion in the various classes.

R. L. Boulden, Superintendent of the Water and Light Department, Riverside, Calif., will deliver an address on "Air Conditioning—Its Effects upon Water Supply and Sewage Disposal," at the June 12 morning session. A 50-minute open forum session for cross-discussion of the subject will follow.

A.C. Men Discuss Heat From Lights with Illuminating Engineers

LOS ANGELES—New officers of Los Angeles Chapter, American Society of Heating and Ventilating Engineers, named at the May 14 meeting, are H. H. Douglas, of the Southern California Edison Co., president; Arthur J. Hess, English & Lauer, Inc., vice-president; Howard Bullock, General Electric Co., secretary; and Wesley Stewart, treasurer.

The 1940-41 board of governors consists of retiring president J. Frank Park, Western Air Refrigeration, Inc.; Marion Kennedy, York Ice Machinery Corp.; O. W. Ott, consulting engineer; and Joseph Griffith, Drayer and Hanson, Inc.

Feature of the meeting was the presentation of two talks—illumination and the relation of light heat radiance to air conditioning by Lloyd Gates of the Los Angeles Bureau of Power and Light, and air conditioning and its relation to illumination by J. Frank Park.

In relating the story of illumination and its application to air conditioning engineers, Mr. Gates pointed out that there are many instances where illumination and air conditioning should, and must, be considered together for the most satisfactory working conditions for both systems. With the innovation of new light sources and principles, he declared, there exist new possibilities for cooler light which should interest air conditioning men.

Mr. Gates discussed the various sources of heat from lights and their inter-relationship to proper conditioning of air. Only 11% of the energy from a 500 watt incandescent lamp, according to Mr. Gates, is light; 70% is radiant heat, which, after striking the ceiling, wall or other object, warms the air and forms one of the problems the air-conditioning and ventilating engineer must counteract; the remaining 19% is convected heat.

In regard to fluorescent lamps, Mr. Gates declared, 13% of the energy is light and 34% radiant heat, the radiant energy per watt of this type of lamp being 60% that of a 500 watt incandescent globe.

Mr. Park, taking up the discussion for the air conditioning men, stated that good lights are a part of the bread and butter of the air conditioning man, and added that "The only way we can handle the heat-from-light situation now is to cool down the air and get it to the level we want. If the excess of the 70% of light heat referred to by Mr. Gates could be removed more economically than by refrigeration, it would be a boon to the consumer and to the air conditioning installer."

Bellamy Stresses Humidity Control in Summer Air Conditioning in Talk Before Natural Gas Section of AGA

HOUSTON, TEX.—The gas industry was urged to emphasize the importance of humidity control in air conditioning in a paper by Charles R. Bellamy presented at the annual convention of the natural gas section of the American Gas Association, held at the Rice Hotel here, May 6-10. Mr. Bellamy is chief engineer of the gas department, Columbia Gas & Electric Corp.

Mr. Bellamy said, in part: "....I would like to review in non-technical language some of the fundamental principles of summer air conditioning. Practically speaking, there are two fundamental systems: first dehumidification with supplementary water cooling; second, refrigeration with or without separate dehumidification equipment. Practically speaking, there are two main methods of refrigeration: 1. Compression; 2. Absorption. For the purposes of this paper we may call the compression system the electrical method and the absorption system the gas method, although there are numerous exceptions to such a classification. From the standpoint of actual air conditioning results it makes little difference which refrigeration system is used, and the customer as a rule is not interested in the energy that motivates the system.

Much of the complaint against commercial air conditioning is undoubtedly due to the unsatisfactory experience that the public has had in railroad trains and theaters. Some of the railroad installations were really discomfort jobs. The theater installations, while not as bad as those of our railroads, have seldom had the capacity and flexibility that are necessary to provide true air conditioning under all load conditions. Hence, many installations which were intended to provide comfort air conditioning could do this only under certain peak load conditions and at other times they became discomfort jobs. Naturally, it is these latter occasions that the theater patrons remember.

For many years the manufacturers of gas equipment have emphasized the importance of humidity control, and I believe our entire industry should support them in this stand. This does not means that we should be biased or fanatics on the subject but rather that we should stand united against the lowering of comfort standards which, while they cheapen the installation cost of air conditioning, also cheapen the results attained. Our position, I think, should be that comfort air conditioning stands for the maintenance of effective temperatures as recommended by the ASHVE not just part of the time but all of the time, with flexibility to vary the actual temperature and humidity of the conditioned air over the full range permitted by the accepted effective temperature chart. While present day knowledge of the effects of entrance and exit shocks may not be very comprehensive, we do know that the American Medical Association Journal has suggested that higher temperatures should be carried in summer air conditioning to prevent shock in hot weather and that certain medical groups have recommended 10F as the maximum temperature differential. Personally, I believe that comfort air conditioning should be able to provide dry bulb temperatures of from 78F to 85F with relative humidities of from 55% to near 30%.

Boston NDHA Meets in Foxboro

FOXBORO, MASS. — Boston section, National District Heating Association, held its spring meeting here, the day session at the plant of the Foxboro Company and the evening session at the Franklin Country Club. Trips were made through the plant of the Foxboro company to observe the manufacture and assembly of instruments of interest to engineers.

At the evening session, metering difficulties, line losses, construction problems and sales promotion were discussed in an informal session. Talks by the following served to open the discussion on each subject: A. Herschel, Foxboro Company, Personnel Educational Problems; C. L. Renker, Boston Edison Company, Metering Difficulties; M. D. Engle, Boston Edison Company, Line Losses; D. H. Little, Boston Edison Company, who discussed construction problems on these two steam lines; G. K. Saurwein, Harvard University, and M. A. Ulbrich, Cambridge Electric Company, Steam Sales Promotion with special reference to steam jet refrigeration and electrically driven steam compression.

A.C. Boosts Cafe Business 33%

BOSTON—George A. Tourain, managing director of the Hotel Tourain, reports that operating cost and purchasing expense of the air conditioning system that serves the Cafe Royal and the cocktail lounge averages less than one cent per person, while the first year the system was installed cafe checks increased by nine cents each and cocktail room checks by twelve cents. Gross business in these rooms increased by 33%.

A.C. Institute Schedules Program for 2-Day Boston Meeting

BOSTON—The First Annual New England Air Conditioning Institute will be held at Massachusetts Institute of Technology June 11-12, according to the Massachusetts Department of Education. The Institute, sponsored by the State Division of University Extension in cooperation with local chapters of ASHVE, ASRE, ASME, AIEE, and the Air Conditioning Bureau of Boston.

Willis H. Carrier, chairman of the board of Carrier Corporation, will be chairman of the opening symposium while Prof. C. P. Yaglou, Harvard University School of Public Health, is chairman of the afternoon session on the first day. Prof. James Holt of MIT will be chairman of the morning session on the second day while Daniel Ricker, president of the Air Conditioning Bureau of Boston, will preside at the afternoon session.

Speakers on the first day's program include J. P. Hare, refrigeration engineer, York Ice Machinery Corporation, Boston, who will speak on refrigeration; H. F. Hagen, vice president in charge of research, B. F. Sturtevant Corporation, Boston, on fans and air distribution; Ralph Franklin, consulting engineer, Alfred B. Franklin, Inc., Boston, on heating; E. Daniel Johnson, New England manager, Buffalo Forge Co., on spray humidifiers and dehumidifiers.

Speakers at the morning session of the second day include Prof. Philip Drinker of the faculty of Harvard University School of Public Health, on atmospheric pollution and air cleaning; Major J. W. H. Myrick, director, Division of Smoke Inspection, Department of Public Utilities, on smoke abatement; W. F. Wells, director of Laboratories for the Study of Airborne Infection, University of Pennsylvania School of Medicine, Philadelphia, on disinfection of air; and R. B. Brown, Jr., illuminating engineer, Boston Edison Electric Co., on lighting in air conditioning.

Speakers at the afternoon session of the second day are John H. Barrett, engineer, Minneapolis-Honeywell Regulator Co., Boston, on temperature and humidity controls; Paul D. Close, technical secretary, Insulation Board Institute, Chicago, on insulation against heat, humidity and sound; St. G. T. Arnold, electrical engineer, Boston Edison Company, on electric motors for air conditioning; and Herman Seid, patent attorney, New York, on air conditioning patents.

The sessions will include demonstrations and possibly arrangements will be completed to visit local air conditioning installations.

3rd Anthracite Industry Conference Held at Lehigh University; Norrman, Turner, Rose and Jillson on Program

BETHLEHEM, PA. — Sounding his gavel promptly at ten o'clock on the morning of May 9 in the auditorium of Packard Laboratory, Lehigh University, Prof. Howard Eckfeldt officially opened the Third Annual Anthracite Conference attended by a record crowd of anthracite operators, retailers, engineers and guests. After an address of welcome by Dr. C. C. Williams, president of Lehigh University and honorary chairman of the conference, the first session was turned over to Chairman Wm. D. Plank, Professor of Mining Engineering, Lafayette College.

A. A. Norrman, fuel engineer of the D. L. & W. Coal Company described the "Proper Use of Domestic Sizes of Anthracite in Home Heating." During the morning session Homer G. Turner, filtration consultant, Anthracite Institute, described the use of anthracite as a filter medium in operations throughout the world, while Dean A. C. Callen of the School of Engineering at Lehigh, outlined the definite opportunities in mining and combustion engineering for young engineers in the 480 square miles of territory comprising the Anthracite field. Interest in the morning session was high-lighted by Dr. H. J. Rose, anthracite fellowship, Mellon Institute of Industrial Research, in his description of the commercial possibilities for the manufacture of mineral wool insulation from anthracite ash and anthracite culm banks.

In the afternoon session, the "Use of Anthracite in Bake Ovens," the "Performance Progress of Anthracite Stokers" and "Important New Data and Research on Chimneys and Draft," from which it was disclosed that 90% of domestic complaints were found to be due to improper firing and inadequate equipment, were discussed. The afternoon's activities were brought to a close by Cadwallader Evans, Jr., vice-president of the Hudson Coal Company and J. D. Jillson, sales engineer, Anthracite Industries, Inc., in their discussion of "The Economics of Preparation of Anthracite" and "Present Market and Future Opportunities of Utilization of Various Sizes of Anthracite."

The afternoon session was adjourned until the dinner meeting held at the Hotel Bethlehem at seven o'clock, at which time the principal speaker was Harry Collins Spillman, representing the National Association of Manufacturers.

On the second day, May 10, Prof. Lauren E. Seeley, Yale School of Engineering, presided over the morning session. This session included papers by B. H. Jennings, Associate Professor of Mechanical Engineering, Lehigh University; A. W. Gauger, director of mineral industries research, The Pennsylvania State College; Eric Sinkinson, Associate Professor of Fuel Technology, Lehigh University; and G. H. Frick, Pennsylvania Power & Light Company. Under the chairmanship of John F. Barclay, Bureau of Mines, E. L. Willson, sales promotion manager of Lehigh Coal & Navigation Company, and J. F. K. Brown, Assistant general manager of engineering, Hudson Coal Company spoke.

The afternoon session was under the chairmanship of S. H. Ash, district engineer of the Bureau of Mines, who presided over the meeting, while Joseph H. Kerrick, combustion engineer, Philadelphia & Reading Coal & Iron Company, and I. J. Fairchild, chief of the division of trade standards, Department of Commerce, outlined the "Practical Results from the Use of Anthracite on Semi-Industrial Stokers" and "Why Have Standards for Burning-Equipment?"

Outdoor Ice Rink for Philadelphia

PHILADELPHIA—An all year sports center, Philadelphia gardens, is being built here on the site of the old Phillies ball park. A feature will be the first large outdoor year-around skating rink to be built east of the Rockies.

The ice rink will measure 200 ft. in length by 85 ft. in width, and will be used for hockey matches, ice carnivals, and public skating. The rink floor will be covered by two sets of steel plates between which cold brine will be circulated, using the system controlled by All-Year Outdoor Ice Skating Rinks, Inc., of New York. The refrigerating equipment is being furnished by the Frick Company of Waynesboro, Penna. There will be two 300 hp., 4 cyl. compressors. The condensers and brine cooler will be large shell vessels. The system will be charged with 5000 lb. of ammonia, and 90 tons of flake calcium chloride will be supplied.

It is expected that the work will be completed in time for the Republican National Convention in June.

Toronto Chapter Elects O'Neill

TORONTO—At a recent meeting of the Ontario chapter, ASHVE, the election of officers resulted as follows: President, James O'Neill, Trane Co. of Canada, Ltd.; vice-president, Fred Ellis, Anthes-Imperial, Ltd.; secretary (re-elected), Harry R. Roth, Canadian Sirocco, Ltd.; Board of Governors: W. C. Kelly, Iron Fireman Mfg. Co. of Canada, Ltd.; Douglas Price, General Steel Wares, Ltd.; and C. D. Tasker, Ontario Research Foundation.

Gifford Elected by Buffalo Group

BUFFALO—Highlighted by election of officers and directors and a talk on building activity, prospects in the Niagara Frontier, the May meeting of the Western New York chapter of the ASHVE was an outstanding one.

Clarence A. Gifford, sales representative of the American Radiator Company, was elected president, succeeding Lawrence P. Saunders of the Harrison Radiator Division of General Motors, Lockport, who automatically becomes a director. Other officers for the coming year are:

First vice-president, William R. Heath, Buffalo Forge; second vice-president, Harry C. Schafer, Iroquois Gas; secretary, Seeley Quackenbush, Quackenbush & Co., and treasurer, Bertram C. Candee, Beman & Candee. Mr. Candee was re-elected to his post.

The following directors were elected: Myron C. Beman, Joseph Davis, David J. Mahoney and Roswell W. Farnham. They will serve for one year along with Mr. Saunders.

Guest speaker of the evening was Howard L. Volgeneau, assistant secretary and chairman of the housing division of the Buffalo Chamber of Commerce. Slanting his talk to the angle of the heating and ventilating engineers, Mr. Volgeneau said the scientific approach to business problems of today is the only one which will result in progress.

"The outlook for residential building in this area is very favorable," Mr. Volgeneau declared. "Land prices are reasonable and there is plenty of property available. Industry, by a process of evolution, is producing more house than ever before for the money. There is better living per dollar of cost."

ASA Completing Its Building Codes

NEW YORK—Among the drafts of proposed standard building code requirements nearing completion by various committees of the American Standards Association are one on chimneys and heating appliances and one on light and ventilation.

The former is known as "Building Code Requirements for Chimneys and Heating Appliances—A52" and consists of an outline of four sections of a proposed standard and a draft covering construction requirements for chimneys and fireplaces. Provisions for safe installation, maintenance, and operation of heating equipment are still to be developed. Underwriters' Laboratories, Inc., is conducting some research on clearances for heating equipment.

The second is known as "Building Code Requirements for Light and Ventilation—A53", sponsored by the F.H.A. and the Bureau of the Public Health Service.

NDHA Runs Prize Thesis Contest for Engineering Students

ROCHESTER—A prize thesis contest with $100 in prizes for students in engineering colleges has been announced here by Landis Shaw Smith, chairman of the Educational Committee of the National District Heating Association.

According to Mr. Smith the contest is intended to increase the understanding and appreciation of district steam heating on the part of company officers and engineers and on the part of the general public as well.

Prizes totaling $100 are to be offered in the form of a first prize of $50, a second prize of $35, third prize $15.

Mr. Smith announces that the contest is to be conducted under the following rules: (1) Contest is open to all regularly enrolled graduate, senior or junior students in engineering colleges and technical schools; (2) Thesis shall deal with some engineering or commercial phase of the district heating industry or be of educational value in acquainting laymen with the advantages of district heating from a central plant; (3) Thesis must be submitted on or before May 15, 1941. (4) Cash prizes will be awarded at the Annual June Meeting of the Association; (5) All material submitted becomes the property of the National District Heating Association, and (6) Prize theses and others may be abstracted and published in the Association Bulletin or other publications.

Additional information regarding details of entry can be had by writing to Landis Shaw Smith, Rochester Gas & Electric Corp., Rochester, N. Y.

ACMA Elects Lauer President

HOT SPRINGS, VA.—Stewart E. Lauer, president of the York Ice Machinery Corporation, was elected president of the Air Conditioning Manufacturers' Association May 11 during the annual meeting here. Other officers elected were: vice-president, stuart M. Crocker, manager, air conditioning department, General Electric Company; and treasurer, P. A. McKittrick, general manager, Parks-Cramer Company.

The board of directors of the Air Conditioning Manufacturers' Association is as follows: chairman, P. Y. Danley, manager, air conditioning department, Westinghouse Electric & Manufacturing Company; vice-chairman, E. T. Murphy, vice-president, Carrier Corporation; Mr. Crocker; J. M. Fernald, general manager, Baker Ice Machine Company, Inc.; F. D. Kirk, general sales manager, Vilter Manufacturing Company; Mr. Lauer; Mr. McKittrick; and H. R. Sewell, vice-president, cooling and air conditioning division, B. F. Sturtevant Company.

Mineral Wool Industry Celebrates Its One Hundredth Year

CHICAGO—The hundredth anniversary of the mineral wool industry was celebrated here May 15-16 at the Centennial Convention of the National Mineral Wool Association. Technical session of the convention was devoted to a discussion of the growing importance of insulation in low cost housing and to reports of the research and experimentation in mineral wool now being undertaken at the Universities of Minnesota and Illinois.

J. S. Irvine presided at the Technical session. Convention speakers included Dr. F. E. Giesecke, Texas A. & M. College; Frank B. Rowley, director of the Engineering Experiment Station at the University of Minnesota; Prof. S. Konzo, University of Illinois; Prof. W. T. Miller, Purdue University, and L. V. Teesdale, Forest Products Laboratory.

Woodruff H. Purnell of the Tennessee Valley Authority described recent tests conducted by the TVA on insulated and uninsulated houses. Robert K. Thulman of FHA, and G. Hicks Fallin, president of the Society of Residential Appraisers, spoke.

According to the Association, enough mineral wool is manufactured annually to insulate 200,000 average American homes against winter cold and summer heat.

Boston Mayor Protests Oil Prices

BOSTON—Mayor Maurice J. Tobin of this city has served notice on fuel oil distributors of the metropolitan area that they will have to reduce the current price of fuel oil from the present $1.50 per barrel for heavy unless they wish to lose a substantial portion of the $500,000 a year business of the city of Boston. Unless a readjustment is made, he will convert as many of the heating plants of the city to the use of coal, and "will lend every possible assistance to the Department of Justice and other government agencies to end this unjust levy on consumers."

The bunker posted price on heavy fuel oil last June 1 was 95 cents a barrel, and it is now $1.50. This would mean $100,000 a year added to the city's fuel bill, and more than $3,300,000 to consumers in the metropolitan area.

Distributors called to the Mayor's office for a conference said high prices resulted from a marked increase in consumption due to New England's last hard winter, and to a war shortage of tankers. But the mayor, in a prepared statement, declared that the increased price represents entirely an assessment on consumers by the owners of tankers who are taking advantage of the shortage of bottoms, and said: "I will not tolerate price-fixing and rigging in this commodity."

Will Study Sound Control in A.C.; Corrosion Experiments Progress

NEW YORK — According to A. E. Stacey, Jr., chairman of the committee on research, the ASHVE will actively sponsor a cooperative research project at Rensselaer Polytechnic Institute, Troy, N. Y., to study sound control problems in air conditioning. The Society is also making progress in its study of corrosion, and several short lengths of pipe made from different materials and arranged in series are being installed in a number of large New York office buildings for the purpose of studying corrosion problems.

Test specimens will be located in the returns of systems supplied with steam from a central district heating source and from individual boiler plants. Action of the return condensate from the heating system on the corrosion of the several pipe materials is to be observed over a long period.

Three factors of fundamental importance are essential in order to enable the engineer and contractor accurately to predict the noise levels in a conditioned space, according to J. S. Parkinson, chairman of the technical advisory committee on sound control, which has been responsible for outlining the research investigations planned at Rensselaer. First it is necessary to know the probable background noise levels which will be encountered in the conditioned spaces; second, it is necessary to know the amount of noise generated by the equipment and the air in the duct system; and, third, it is necessary to have a means of predicting sound attenuation through the duct system with and without the use of special sound absorbent materials.

The Rensselaer investigations are initially planned to develop a technique for measuring sound inside a duct and at the room outlet. Then the effect of duct size, thickness of metal, bends, elbows, turning vanes and splitters will be studied to determine the various attenuation losses which occur between the fan or conditioning apparatus and the room outlet.

Oil Burners Active in New Britain

NEW BRITAIN, CONN.—Since last September, oil burners for heating purposes have been installed here at the rate of about 45 a month, according to John W. Leonard, oil burner inspector of the Fire Board, a rate about double that of last year. He estimates that there are about 2500 oil burners here now. He suggests that arrangements be made for inspection every six months of all burners installed in public buildings lest they be allowed to get in such a condition that an explosion may be caused.

A.C. Found Profitable by Doctors

PHILADELPHIA—Seventy-two per cent of the physicians now using air conditioning have recommended it to other doctors, 48% have recommended it to their patients and 47% have recommended it to their personal friends, according to *Medical Economics* magazine, following an extensive nationwide survey on this subject.

Of particular interest is the medical profession's attitude toward the reputed health values of air conditioning and the benefits to patients suffering from various ailments. Seventy-two per cent believe that hay fever sufferers will enjoy a marked relief while 63% think it has therapeutic values for asthma. Persons afflicted with sinus conditions will notice a great amount of relief by using air conditioning.

Other favorable experiences were also mentioned with rheumatic, cardiac, heat exhaustion and fever patients.

The survey revealed that 98% of the patients commented favorably on the added comfort of air conditioning and that 29% of the doctors could trace an increase in practice to the drawing power of the air conditioned office.

Boston Burner MenAdopt Standards

BOSTON—Members of the Boston Oil Burner Associates held a dinner meeting May 14, at which they adopted Minimum Standards Regulating the Installation and Operation of Automatic Mechanical Oil Burners, Designed for Light Fuel Oil.

Guest speakers were Ross Sherman, chairman, Standards Committee, Oil Burner Institute; C. F. Curtin, national secretary, Oil Burner Institute; W. A. Matheson, chairman of the legislative committee, Oil Burner Institute; and Stephen C. Garrity, Fire Marshal of Massachusetts. This was the last regular meeting of the season and was attended by about 180 members of the oil burner industry.

For several months the officers of the organization and a special committee have been working on a set of standards for governing the industry in this state, to forestall legislation such as the Sharkey Bill in New York. The various agencies have agreed to cooperate and see that the new standard regulations are enforced. They prescribe what are said to be reasonable provisions for the installation of oil burners, based on a minimum of requirements for the safety of life and property, combined with a minimum of service and replacement to the purchasers.

They are compiled from the rules and regulations of the Massachusetts Department of Public Safety, Oil Burner Ordinance, National Fire Protective Association and other sources.

Knox Talks on Stoker Operation

PITTSBURGH—Engineering principles involved in coal stoker construction by which coal dealers can determine the possible reasons for customer complaints were explained by Walter Knox, director of the Koppers Stoker Coal Research Laboratory, Kearny, N. J., at the two-day convention of the Indiana Coal Merchants Association in Indianapolis, May 14-15.

Mr. Knox's talk, "The Mechanical Features of Stokers," discussed factors involved in efficient stoker operation and which can be applied by dealers in determining the reasonableness of possible complaints and determining whether the cause lies in the stoker or the coal.

"Coking difficulties or packing of coal in the worm may be the result of improper adjustment or design of the coal-feeding mechanism," said Mr. Knox. "Under conditions producing excessive crushing or packing, which may cause heavier coking, the power consumption is also excessive. With correct operation the coal should move loosely through the coal tube, thus giving only moderate crushing (which is desirable to avoid "smoke back") and requiring very little power to convey it. To achieve this, the point of greatest constriction of the coal should be at the entrance to the coal tube. Loosening of the coal after passing this point may be accomplished in various ways, such as increasing the pitch of the screw.

"When the spike trap is part of the entrance to the coal tube it should be lowered to correct packing or excessive crushing in the tube. Many service men have the mistaken idea that raising the spike trap lessens packing and crushing of coal. This is fundamentally wrong. You cannot force coal into the large end of a funnel and out the small end very successfully. Lowering of the spike trap, putting it down as close to the coal screw as possible without actually rubbing, is the correct procedure."

Fuel Oil Price for New York Set

NEW YORK—The Standard Oil Company of New Jersey announced May 24 that a top price for heating oil delivered to consumers with contracts for the six months from June 1 to Dec. 1, next, will be 7.25 cents a gallon in New York City and metropolitan New Jersey. For the six months from Dec. 1 to May 31, 1941, the contract maximum will be 7.70 cents in New York City and 7.75 cents in metropolitan New Jersey. The maximums in Westchester and Nassau Counties will be two-tenths of a cent a gallon higher.

The company said maximum prices for other points will vary according to the distance from refineries.

200 at Oregon A.C. Conference

CORVALLIS, ORE.—With 200 present, the third annual Oregon State Air Conditioning Conference was the most successful of the three so far held. Manufacturers' equipment exhibits completely filled the mechanical engineering laboratory at Oregon State College where the conference was held. Joint sponsors were the mechanical engineering department and the new Oregon chapter of the ASHVE.

Twelve members of the Oregon chapter presented papers on various subjects at the technical and semi-technical sessions. Dr. F. E. Giesecke, ASHVE president, presented a paper on radiant cooling and heating.

Other out-of-state speakers were Herbert K. Kunen, Anemostat Corporation, New York; R. P. Dewey, Barber-Colman Company, Rockford, Ill.; John E. Mueller, Payne Furnace & Supply Company, Beverly Hills, Calif.; and J. A. Ryan, Standard Oil Company, Richmond, Calif.

A high-light of the 1940 conference was installation of new officers of the Oregon chapter, as follows: T. E. Taylor, president; J. F. McIndoe, vice-president; C. M. MacGregor, treasurer; B. W. Moore, secretary; W. T. Finnigan, J. A. Freeman, and retiring president J. Donald Kroeker, members of the new board of governors.

Fanless Phone Booths for Fair

NEW YORK—Because about half the electric fans installed in 850 public telephone booths at the World's Fair last year disappeared, the New York Telephone Company has decided that fanless booths will be the rule this year.

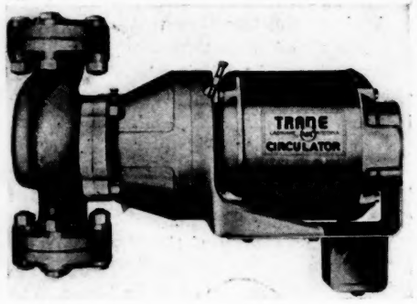
The small fans with rubber blades became so popular that many persons tore them from their mountings. Checks in other parts of the city where the fans were installed showed heavy losses. The telephone company regretfully decided it could do nothing this year to lessen the Turkish-bath temperature of the booths on a hot Summer day.

Four fanless booths were installed recently in the World's Fair City Hall near the South Gate.

Town Says Utility Violates Law

CLINTON, MASS.—Charges that the Wachusett Gas & Electric Company is illegally engaged in the steam-heating business have been made to the Massachusetts Department of Public Utilities by Wycliffe C. Marshall, as counsel for the town of Clinton, which is seeking a reduction in its electrical rates. He asked that the commission request the attorney-general to prosecute officials of the company for this alleged violation of the law.

NEW EQUIPMENT



Trane Circulators

Trane Warm Water Heating Systems

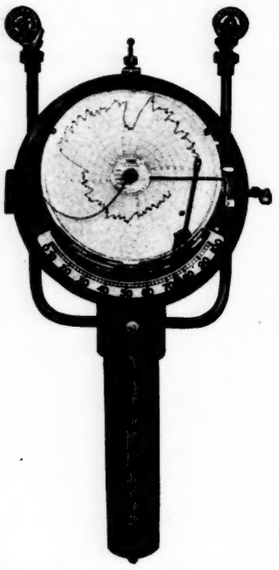
NAME—Trane warm water heating systems.
PURPOSE—For residential heating using water as a heat transfer medium.
FEATURES—This system is a one-pipe, pressure, forced, hot water system and consists of a hot water boiler, Flo Valve, circulator, single pipe flow fittings, Trane convectors, and automatic feed and relief valve. The circulator is said to be carefully balanced for quiet vibration performance. The Trane Flo Valve is designed to control the water circulation and permits circulation only when heat is required. The flow fittings are available for both iron and copper pipes and are attached to the return pipe from each convector. The automatic feed and relief valve is designed to maintain the proper pressure on the system. Convectors are available in fully recessed, semi-recessed, and free standing models.
LITERATURE AVAILABLE—Bulletin S355.
MADE BY—*The Trane Company, La Crosse, Wis.*

Richmond Engineering Water Chiller

NAME—RECO Freon dry expansion water chiller.
PURPOSE—For cooling water using direct expanded Freon.
FEATURE—Manufacturer states that the outstanding feature of this water chiller is the method of passing the Freon through the coils. On entering the chiller, the Freon liquid vapor and oil are thoroughly mixed to assure an even feed to each tube and to obtain a uniform transfer of heat through each tube. The mixture is given a whirling action to increase the heat transfer and to assure an even feed of Freon to the tubes. After passing through the first series of tubes, a baffle is employed to keep the area of the Freon passage the same as the area of the first row of tubes. This is said to result in a definite check against oil trapping in the Freon head. The number of tubes in the second pass is increased to maintain a constant velocity since the Freon is considerably expanded by the time it reaches these tubes.
CAPACITIES AVAILABLE—5 to 200 tons.
MADE BY—*Richmond Engineering Company, Inc., Seventh and Hospital Streets, Richmond, Va.*

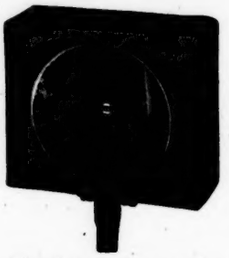
Dry expansion water chiller

ADSCO Flow Meter



For measuring steam, water, air or gas flow

NAME—ADSCO flow meter.
PURPOSE—For metering of steam, water, air or gas.
FEATURES—Instrument operates in conjunction with an orifice plate in the pipe line and records the flow on a large chart. All charts and counters show the flow directly and immediately. Meter is said to maintain its accuracy under the most severe conditions. Meter is offered in 4 types: (1) recording only, (2) recording and integrating, (3) indicating and recording and (4) indicating, recording and integrating. In addition, an auxiliary pressure recorder can be fitted to any model to record the working pressure on the same chart as the flow.
LITERATURE AVAILABLE — Bulletin 35-83.
MADE BY—*American District Steam Company, North Tonawanda, N. Y.*



Marsh pressure recorder

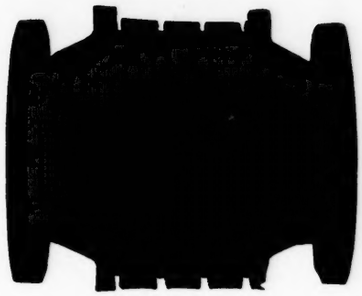
Marsh Recorders

NAME—Marsh miniature recorders.
PURPOSE—For recording either temperature, pressure, cycle operation, or humidity.
FEATURES—These recorders are said to be moderately priced and portable. They measure 5 in. x 6 in. x 2¼ in. Included in all of the recorders is a fully adjustable clock movement to give a 24 hour record. All recorders are housed in cast aluminum, finished in satin black. Recording thermometers are available in a wide variety of ranges to record as low as —20F to as high as +110F. Pressure recorders are available in a wide variety to record pressures from as low as 30 in. vacuum to as high as 300 lb. Humidity recorders are suitable for use on temperatures between freezing and 125F and for a range from 0 to 100% R.H. Cycle recorders are designed to clearly indicate alternate periods of on and off operation. Each recorder is packed in a box containing 50 charts, bottle of ink and dropper.
MADE BY—*Jas. P. Marsh Corporation, 2073 Southport Avenue, Chicago, Ill.*

M-H Duct Thermometer

NAME—M-H remote bulb thermometer W59A.
PURPOSE—For measuring air temperatures in ducts.
FEATURES—This thermometer is said to be designed specially for air conditioning applications and incorporates a remote bulb with a mounting clip to permit mounting the operating element where it will measure the temperature at the desired point within the duct. The thermometer is equipped with a universal mounting bracket which allows the face of the thermometer to point to the right, left or straight ahead and also to point at any angle between vertical and horizontal. Model W59B thermometer is similar to W59A except that it does not have a flexible element, but has instead a protecting well and is intended for insertion in water pipes or tanks. Both models have a range from —30 to +180F.
MADE BY—*Minneapolis-Honeywell Regulator Company, 2950 Fourth Avenue South, Minneapolis, Minn.*

BADGER EXPANSION JOINTS



Everything

YOU NEED IN AN EXPANSION JOINT

★ Packless—which means no maintenance or servicing throughout its long life.

★ Wide range of traverses from which to select; no need of buying excess capacity for short traverses.

★ Stainless steel as well as copper types, making them suitable for a wide range of pressures and temperatures.

★ Self-equalizing types are made to the Directed Flexing design, a notable improvement in the corrugated type of expansion joint resulting in greatly increased life.

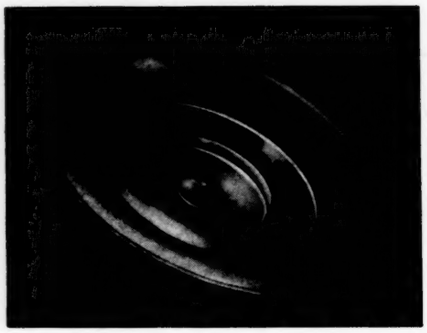
★ Thorough heat-treatment throughout fabrication under the guidance of skilled metallurgists.

From the above, it can readily be seen that the Badger Expansion Joint is an engineered joint for the job that calls for engineering treatment, namely, the expansion and contraction of pipe lines.

E. B. BADGER & SONS CO.

75 PITTS STREET, BOSTON, MASS.

Agents in Principal Cities



For draftless air distribution

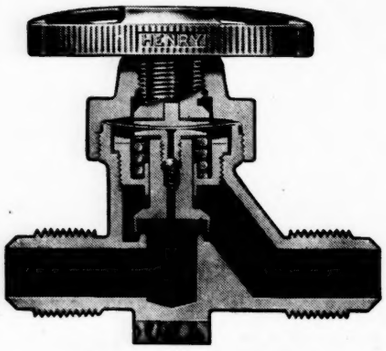
Plandaire Air Distributor

NAME—Kno-draft ceiling type air distributing device.
PURPOSE — For introducing conditioned air into rooms.
FEATURES—Manufacturer states that these devices offer draftless diffusion, low resistance, and equalization of temperatures within the occupied zone. They are said to be easy to install, to effectively handle large volumes of air, and to pre-mix room air and supply air. Manufacturer further states that this device has a low decibel rating, is light in weight, and permits the use of higher duct velocities which result in smaller ducts and lower duct costs.
SIZES AND CAPACITIES—12 sizes with capacities ranging from 100 to 16,000 c.f.m.
MADE BY—*Plandaire, Inc., 207 Fulton Building, Pittsburgh, Pa.*

Richmond Engineering Water Cooler and Condenser

NAME—Cross draft Freon water chillers and condensers.
PURPOSE—For cooling water using Freon as a refrigerant, or for condensing Freon using water as a cooling medium.
FEATURES—Outstanding feature of this unit is that there are several Freon inlets designed to give a uniform agitation of the liquid in the cooler. Manufacturer states that the high speed jet of flash gas and incoming liquid impinges into the shell which in turn induces circulation, mixing, and agitation. It is also said that these inlets eliminate dead spots where efficiency might be poor and where oil traps would occur. Tubes are made of copper and are ⅝-in. in diameter. They are staggered in such a manner as to result in much agitation in the rising vapor. Manufacturer states that there are no Freon gaskets, that the unit is easily cleaned and there are no moving parts.
SIZES AND CAPACITIES—60 sizes with capacities ranging from ½ to 250 tons in the water chillers and up to 350 tons in the condensers.
MADE BY — *Richmond Engineering Company, Inc., Seventh and Hospital Streets, Richmond, Va.*

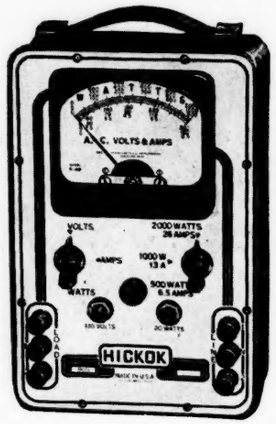
For use as a condenser or water cooler



For handling dangerous fluids

Henry Packless Valve

NAME — Henry Balanced-action diaphragm packless valves.
PURPOSE—For controlling the flow of liquids or gases which are dangerous and hard to handle.
FEATURES—These valves have no stem packing which is said to eliminate this source of leak. The diaphragm used in this valve is said to furnish a seal whether the valve is open or closed, In order to assure positive opening at all times, the pressures above and below the seat are equalized at the instant of opening. To accomplish this, a balancing channel is provided at the axis of the stem. When the valve is closed, the top port of this channel is sealed by contact with the bottom diaphragm. When the handwheel is turned to open the valve, the diaphragm rises and exposes the upper port of the balancing channel, which in turn releases the high pressure above the seat through the channel to the low pressure area below the seat. This equalizes the pressures and is said to allow the valve to be opened easily. Diaphragm life is said to be lengthened by the use of a 4-ply diaphragm. Other features include oval handwheels and inlet and outlet ports directly in line.
SIZES AVAILABLE—Available in all standard types, two-way and three-way and angle in the following size range: flare fittings, ¼ to ⅝ in.; solder connections, ¼ in. O.D. to 1⅛ in. O.D., and male pipe thread, ¼ in. to 1 in.
MADE BY—*Henry Valve Company, 1001-19 No. Spaulding Ave., Chicago, Ill.*



For air conditioning appliance testing

Hickok Electrical Appliance Tester

NAME — Hickok Volt-Amp-Wattmeter, model 900.
PURPOSE — For measuring actual equipment loads in volts, amperes, and watts.
FEATURES—Manufacturer states that this device has been designed especially for air conditioning appliance testing. The scales have been extended to enable testing appliances as small as bell transformers and clocks to those as large as electric ranges operating on a 220-volt 3-wire Edison system. It is further stated that this device tests appliances while in actual operation and indicates wattage consumption, amperes, and line voltage. The instrument is intended for single phase use but may be used on polyphase circuits by testing one phase at a time. Unit is mounted in a steel case with a wear-proof metal panel.
CAPACITIES—A.C. watts, 0 to 2000; A.C. amps, 0 to 26; A.C. milliamps, 0 to 260, and A.C. volts, 0 to 260.
MADE BY—*The Hickok Electrical Instrument Co., Cleveland, Ohio.*

Friez Gas Valves

NAME — Single-Port Magnetic Gas Valves.
PURPOSE—For the control of floor furnaces, gas humidifiers, safety pilots, or diaphragm valves.
FEATURES—Operation of these valves is by a flapper type armature. The valve has a metal to metal ground face with self-adjusting valve made of monel metal. Internal parts are electrically tinned to guard against corrosion. Valves can be supplied in line voltage (110) or low voltage (20).
SIZES—Four sizes, ⅛, ¼, ⅜ and ½ in.
LITERATURE AVAILABLE—Bulletin VG/B.
MADE BY—*Julien P. Friez & Sons, Div., of Bendix Aviation Corporation, Baltimore, Md.*

IT WILL PAY YOU TO SPECIFY
RIC-WIL PRE-SEALED INSULATED PIPE UNITS
For Underground and Overhead Piping

STABILITY
STRENGTH
SIMPLICITY
REAL PIPE SUPPORT AND GUIDE SCREW INTO CONDUIT — REMOVABLE
PIPE AND ITS COVERING FREE FROM ANY LOAD ON THE CONDUIT
HEAVY ASPHALT SHELL IS OUTSIDE OF AND SUPPORTED BY STRONG ARMCO CONDUIT
CROSS SECTION
DURABLE WATERTIGHT ENGINEERING
RIC-WIL INSULATED PIPE UNITS

BECAUSE

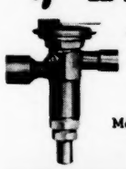
The Armco Helical Conduit has the inherent PERMANENT strength required—durable, watertight and lightweight. Furnished with any kind of pipe or insulation. A complete system, in standard lengths, which will stand any engineering test. Compare RIC-WIL details with other systems and you will be convinced. Write for latest bulletin.

Strength Underground

THE RIC-WIL CO.
CLEVELAND, OHIO
AGENTS IN PRINCIPAL CITIES

Strength Overhead

of AIR-CONDITIONING VALVES TO CHOOSE FROM



TYPE L — Sweat Connections — Freon 10 Tons — Methyl Chloride 20 Tons

TYPE R — Single Flange With Sweat Connections (Angle) — Freon 10 Tons — Methyl Chloride 20 Tons

TYPE O — Straight Through Flanged With Solder Flanges — Freon 10 Tons — Methyl Chloride 20 Tons

TYPE P — Straight Through Flanged With Solder Flanges — Freon 20 Tons — Methyl Chloride 40 Tons

TYPE T — Straight Through Flanged With Solder Flanges — Freon 50 Tons — Methyl Chloride 100 Tons

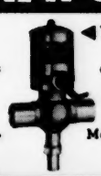
TYPE S — Single Flange With Sweat Connections (Angle) — Freon 20 Tons — Methyl Chloride 40 Tons

to give you **PEAK PERFORMANCE** on all AIR-CONDITIONING INSTALLATIONS

TYPE H — Flare Connections — Freon 3 Tons — Methyl Chloride 6 Tons

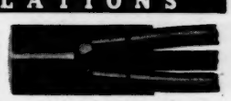
TYPES 10 and 20 — F. P. T. Connections — Freon 4 Tons — Methyl Chloride 8 Tons

TYPE 40 — Sweat Connections — Freon 9 Tons — Methyl Chloride 18 Tons



TYPE 50 — Sweat Connections — Freon 20 Tons — Methyl Chloride 40 Tons

PILOT CONTROL — A Magnetic Shut-off for Sporlan Expansion Valves



▲ Refrigerant Distributor for Multi-Circuit Evaporators

SPOEHRER-LANGE COMPANY
3725 COMMONWEALTH AVE. • • ST. LOUIS, MISSOURI

Degree-Day Figures for April, 1940

HEATING & VENTILATING continues its twelfth year of publishing degree-day data for various large cities

	Albany, N. Y.	Atlanta, Ga.	Baltimore, Md.	Birmingham, Ala.	Boston, Mass.	Buffalo, N. Y.	Burlington, Vt.
Degree-days for April, 1940	698	210	442	150	642	744	773
Degree-days, Sept. 1, '39 to Apr. 30, '40	7414	3556	4741	3177	6113	6906	8116
Degree-days, Sept. 1, '38 to Apr. 30, '39	6769	2552	3944	2235	5626	6351	7624
Degree-days, Sept. 1, to Apr. 30, Normal	6397	2890	4511	2352	5800	6475	7238

	Cheyenne, Wyo.	Chicago, Ill.	Cincinnati, Ohio	Cleveland, Ohio	Columbus, Ohio	Denver, Colo.	Des Moines, Iowa
Degree-days for April, 1940	691	614	455	657	516	513	506
Degree-days, Sept. 1, '39 to Apr. 30, '40	6437	6187	5365	6158	5695	5085	6404
Degree-days, Sept. 1, '38 to Apr. 30, '39	6841	5616	4438	5286	4843	5455	5780
Degree-days, Sept. 1, to Apr. 30, Normal	6894	6042	4684	5935	5311	5607	6266

	Detroit, Mich.	Dodge City, Kan.	Duluth, Minn.	El Paso, Tex.	Erie, Pa.	Evansville, Ind.	Fort Wayne, Ind.
Degree-days for April, 1940	662	364	839	93	693	342	584
Degree-days, Sept. 1, '39 to Apr. 30, '40	6606	4967	8342	2377	6433	4852	6401
Degree-days, Sept. 1, '38 to Apr. 30, '39	6035	4527	8779	2499	5656	3857	5579
Degree-days, Sept. 1, to Apr. 30, Normal	6264	4988	8721	2428	6016	4244	5795

	Fort Worth, Tex.	Grand Rapids, Mich.	Green Bay, Wis.	Harrisburg, Pa.	Hartford, Conn.	Indianapolis, Ind.	Ithaca, N. Y.
Degree-days for April, 1940	134	620	723	523	638	480	669
Degree-days, Sept. 1, '39 to Apr. 30, '40	2523	6445	7306	5652	6433	5626	6909
Degree-days, Sept. 1, '38 to Apr. 30, '39	2168	5940	7104	5001	5689	4752	6261
Degree-days, Sept. 1, to Apr. 30, Normal	2148	6361	7503	5285	5834	5239	6477

	Kansas City, Mo.	Knoxville, Tenn.	La Crosse, Wis.	Lansing, Mich.	Lincoln, Neb.	Little Rock, Ark.	Los Angeles, Calif.
Degree-days for April, 1940	362	247	604	687	451	202	115
Degree-days, Sept. 1, '39 to Apr. 30, '40	5269	4079	7045	6940	6076	3486	699
Degree-days, Sept. 1, '38 to Apr. 30, '39	4446	3238	6769	6407	5256	2766	1184
Degree-days, Sept. 1, to Apr. 30, Normal	4840	3670	7139	6819	5900	2811	1414

	Louisville, Ky.	Madison, Wis.	Memphis, Tenn.	Milwaukee, Wis.	Minneapolis, Minn.	Nashville, Tenn.	New Haven, Conn.
Degree-days for April, 1940	359	654	196	707	639	259	602
Degree-days, Sept. 1, '39 to Apr. 30, '40	4915	7073	3624	6613	7710	4126	5992
Degree-days, Sept. 1, '38 to Apr. 30, '39	3938	6666	2733	6187	7588	3169	5354
Degree-days, Sept. 1, to Apr. 30, Normal	4180	7193	2950	6856	7614	3507	5672

	New Orleans, La.	New York, N. Y.	Norfolk, Va.	Oklahoma, City, Okla.	Omaha, Neb.	Peoria, Ill.	Philadelphia, Pa.
Degree-days for April, 1940	48	571	301	228	473	456	501
Degree-days, Sept. 1, '39 to Apr. 30, '40	1594	5531	3786	3730	6340	6065	5175
Degree-days, Sept. 1, '38 to Apr. 30, '39	1008	4770	2774	3248	5557	5385	4421
Degree-days, Sept. 1, to Apr. 30, Normal	1024	5192	3350	3613	6047	5988	4787

	Pittsburgh, Pa.	Portland, Me.	Portland, Oreg.	Providence, R. I.	Reading, Pa.	Reno, Nev.	Richmond, Va.
Degree-days for April, 1940	504	738	295	617	528	444	343
Degree-days, Sept. 1, '39 to Apr. 30, '40	5606	6926	3283	6079	5530	4454	4379
Degree-days, Sept. 1, '38 to Apr. 30, '39	4741	6556	3625	5469	4830	4889	3415
Degree-days, Sept. 1, to Apr. 30, Normal	5157	6644	4134	5764	5293	5436	3727

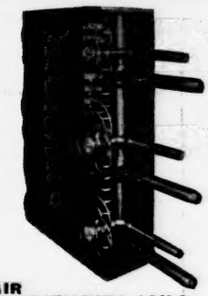
	Rochester, N. Y.	St. Louis, Mo.	Salt Lake City, Utah	San Francisco, Calif.	Scranton, Pa.	Seattle, Wash.	Spokane, Wash.
Degree-days for April, 1940	676	349	375	221	633	327	435
Degree-days, Sept. 1, '39 to Apr. 30, '40	6832	4980	4494	1793	6504	3332	5211
Degree-days, Sept. 1, '38 to Apr. 30, '39	6222	4089	5208	2303	5736	3845	5499
Degree-days, Sept. 1, to Apr. 30, Normal	6472	4585	5319	2417	5958	4396	5989

	Springfield, Ill.	Syracuse, N. Y.	Toledo, Ohio	Trenton, N. J.	Utica, N. Y.	Washington, D. C.	Wichita, Kan.
Degree-days for April, 1940	418	688	627	554	720	426	343
Degree-days, Sept. 1, '39 to Apr. 30, '40	5566	6978	5479	5618	7554	4846	4819
Degree-days, Sept. 1, '38 to Apr. 30, '39	4797	6212	5698	4848	6831	3988	4183
Degree-days, Sept. 1, to Apr. 30, Normal	5317	6614	5897	4852	6543	4601	4673

Methods of applying the degree-day in connection with the operation of heating plants or for the prediction of fuel consumption of heating plants are described fully in the new enlarged edition of the DEGREE-DAY HANDBOOK, published by HEATING & VENTILATING, 148 Lafayette Street, New York, price $3. Degree-days as given above for a "normal" month or season are based on averages for a long period of years, ending about 1922. Averages covering different periods will disagree with the above figures slightly.

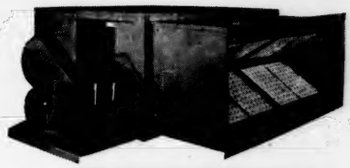
Marlo Coil Co.

6135 MANCHESTER AVE.,
ST. LOUIS, MO.



AIR CONDITIONING COILS—BLAST COILS

Extended surface coils for all refrigerants. Made of any of the common metals. Blast coils for steam, water, or brine. Complete details in Bulletin No. 396.



AIR CONDITIONING UNITS

Air Conditioning Units in either ceiling suspended or floor type. Capacities from 900 cu. ft. to 12,000 cu. ft. Sturdily built on welded angle iron frames of sectional design for easy installation. Bulletin No. 409 gives complete details.

Refrigeration Equipment Manufacturers

EVAPORATIVE CONDENSER

Self-contained; single motor drive for fans and pump; all prime surface coils; electric welded frame galvanized after fabrication; internal surface covered with corrosion resistant mastic. Full details in Bulletin No. 404.

Y—5R1

Instantaneous Direct Reading All Purpose

AIR VELOCITY METER

The Alnor Velometer is a sensitive, accurate, durably built and easily used portable instrument. Indispensable to engineer and technician for measuring air velocities for all types of grilles, ceiling outlets and ducts. Write for bulletin giving detailed information.

ILLINOIS TESTING LABORATORIES, INC.
143 W. Hubbard St. CHICAGO, ILL.
Manufacturers of electric thermometers and pyrometers

SOMERS HAIR GLASS FILTER

Make the first cost the last cost!

Where Somers Hair Spun Glass Filters are installed as original or replacement equipment there's an end to the cost. Somers Filters are washable, odorless, non-absorptive, do not rot, and are practically indestructible.

Dust, dirt, pollen and detritus in the air stream effectively removed with minimum back pressure. No adhesives required.

Somers Filters may be cleaned easily by using the stream from an ordinary water hose (at city pressures) pinched to obtain a spray effect.

For complete details and prices, write giving the c.f.m. per unit and dimensions of present master holding frame. A few choice territories are available for representatives. Full particulars on application.

H. J. SOMERS, INC., 6065 WABASH AVE., DETROIT, MICH.

LET US HELP YOU GET YOUR SHARE OF FAN and BLOWER INSTALLATIONS

We Know How!

. . . Over 60 Years' Experience (1879-1940)

You can earn big profits in all kinds of processing, industrial and manufacturing plants by solving problems of **exhausting, collecting, drying, conveying, heat circulation, etc.**

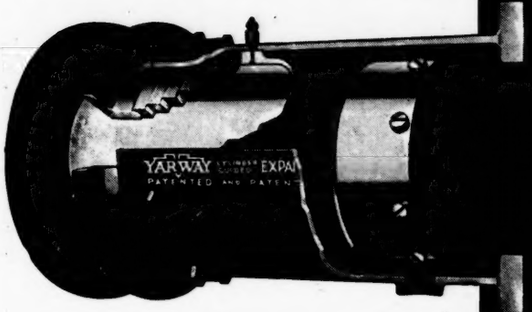
We can help you get this business. Our experience has brought us in contact with practically every known industrial requirement and much valuable information is available that means extra profits for you.

Canvass your City—consult us on problems—and make 1940 a year of better business.

Complete catalog file on application. Write for it today.

GARDEN CITY FAN CO., Mfrs.
332 So. Michigan Ave. Chicago, Ill.
NEW YORK PHILADELPHIA DETROIT MILWAUKEE CINCINNATI

CYLINDER-GUIDED FOR TROUBLE-FREE SERVICE



Made in single or double end types with or without base.

YARWAY
EXPANSION JOINTS

Welded Steel construction. Alemite lubrication. Diameter no larger than pipe flange . . . Outside cylinder guide design prevents abrasive sediment from cutting the sleeve. Write for catalog EJ-1904, which describes both Gland Pakt and revolutionary Gun-Pakt packed under pressure types.

YARNALL WARING COMPANY, Philadelphia

ASSURES EFFICIENT COOLING

You can be absolutely certain of cooling all the chilled water required for cooling systems by installing a Patterson Freon Cooler. That it will deliver at rated capacity continuously has been proved in hundreds of installations.

The reason for the dependable operation of Patterson Coolers is that every one is designed and built to meet the requirements of each individual job by engineers who have an experience of 60 years to guide them.

Write for a copy of our Freon Cooler catalog.

THE PATTERSON-KELLEY CO., INC.
105 Burson St., East Stroudsburg, Pa.

Patterson Freon Water Coolers

E-Z

Radiator Hangers The efficient, durable, economical way to hang radiators. A type for every radiator and every situation.

Concrete Inserts Only one size is needed for all size pipe hangers. Easily adjustable, with play for expansion.

Lavatory Hangers The strong, permanent, economical way to suspend lavatories from the wall.

HEALY-RUFF CO., 772 Hampden Ave.
St. Paul Minnesota

NOZZLES for Air Washing

Yarway Involute Design—with no internal parts or vanes — insures non-clogging trouble-free service. Sizes and types to meet all requirements. Successful installations of Yarway Involute Nozzles in water cooling and air conditioning service total more than 5 million gallons per minute. Write for Bulletin N-615.

YARNALL-WARING CO., PHILA.
104 MERMAID AVENUE

YARWAY

COMING EVENTS

JUNE 9-11. Summer meeting of the American Society of Refrigerating Engineers; Skytop, Pa.

JUNE 17-19. Summer meeting American Society of Heating and Ventilating Engineers; Washington, D. C.

OCTOBER 8-11. The 69th annual meeting of the American Public Health Association, Detroit. Book-Cadillac Hotel, Headquarters.

DECEMBER 2-7. 14th National Exposition of Power & Mechanical Engineering at the Grand Central Palace, New York, N. Y. For information write National Exposition Co., Grand Central Palace, New York, N. Y.

H&V'S PHOTOS

Cover—Ford Motor Company, Dearborn, Mich.
Page 22—Ewing Galloway, New York, N. Y.
Page 25—Smith, Hinchman & Grylls, Inc., Detroit, Mich.
Pages 31, 32, 34, 35 and 36—Ford Motor Company, Dearborn, Mich.
Page 39—C. G. Conn, Ltd., Elkhart, Ind.

WITH THE MANUFACTURERS

American Chain & Cable Company, Inc., Bridgeport, Conn., announces that the *Julian d'Este Co.*, Boston, has been merged with its organization, and that d'Este products will be manufactured in the American Chain plant at Reading, Pa.

The Armstrong Machine Works, Three Rivers, Mich., has appointed *Frederick G. Stamm*, authority on paper drying, to head a newly organized Paper Mill Division of the company. Mr. Stamm and Armstrong engineers are reported to have pooled their experience and resources to design and build advanced types of equipment for controlling drying on and drainage of paper machines. The new division is prepared to render specialized paper mill engineering service.

Controlair, Inc., Elyria, Ohio, has been organized to manufacture and sell the Mayn air balancer for forced warm air systems. The officers of the company are *J. Earle Maynard*, president; *Charles L. Whidden*, vice president in charge of production, and *Paul O. Collins*, secretary-treasurer. Mr. Maynard will not be active, being otherwise employed by the American Radiator & Standard Sanitary Corporation. Mr. Collins assumes charge of business and management and sales.

Electrol Incorporated, Clifton, N. J., announces that at a meeting of the board of directors, *Stanley H. Brown* was unanimously elected president to succeed *Morgan J. Hammers*. Mr. Brown was branch manager for Socony Burner Corp. in its branch at Hempstead, L. I., in 1924. He left that company when Timken took over its operation and joined Petroleum Heat & Power Company in 1928, first in charge of sales in the New York area, then in a similar capacity in Chicago. From 1930 to 1934 he was manager of the fuel oil division of Petroleum Heat & Power Company. From 1934 to 1938 he operated and owned the Electrol branch at Rockville Centre, L. I. He came with the Electrol factory in January 1938. On April 1st, 1938, he was made executive vice president and later on treasurer as well.

Maid-O'-Mist, Inc., Chicago, has appointed the following manufacturer's representatives: *E. F. Tierney*, 19 State Street, Westfield, Mass.; *G. Cliff Carroll*, Builders Exchange, Cleveland; *W. D. Carter*, 6120

Eastwood Terrace, Norfolk, Va.; *Fred E. Triggs,* Box 1, Highland Park, Des Moines, Iowa, and *Heating Assurance, Inc.,* 124 E. Augusta Ave., Spokane, Wash.

L. J. Mueller Furnace Co., Milwaukee, has appointed *James R. Scott* as assistant to the president. Mr. Scott for the past seven years was engaged in sales engineering for Surface Combustion Corporation.

Oil Devices, Santa Fe, New Mexico, announces that *Stanley Perry* has jointed its staff as chief engineer. Mr. Perry formerly was assistant chief engineer of the Automatic Burner Corporation of Chicago. The company is engaged in development work on oil burners invented by *James Breese* who directs the efforts of the organization and the company also conducts an extensive consulting engineering service for its customers. General sales operations are conducted by *J. G. Gilmore* from Columbus, Ohio.

The Trane Company, La Crosse, Wis., has appointed *A. A. Kernjack* as manager of the Peoria, Ill., district. Mr. Kernjack succeeds *H. B. Davis* who becomes manager of the national accounts sales department at the home office. Mr. Kernjack formerly was the Trane representative in Appleton, Wis., where he is succeeded by *Harry Koller.*

Utility Fan Corporation, Los Angeles, Calif., is adding to its line of gas-fired heating equipment.

York Ice Machinery Corp., York, Pa., has appointed *John G. Bergdoll* as chief engineer. Mr. Bergdoll, a graduate of Lehigh University, was first employed by the York Ice Machinery Corporation as a machinist's apprentice in 1914 in connection with the York high school cooperative course, and since then has occupied the position of draftsman, equipment development engineer, product engineer, and assistant chief engineer.

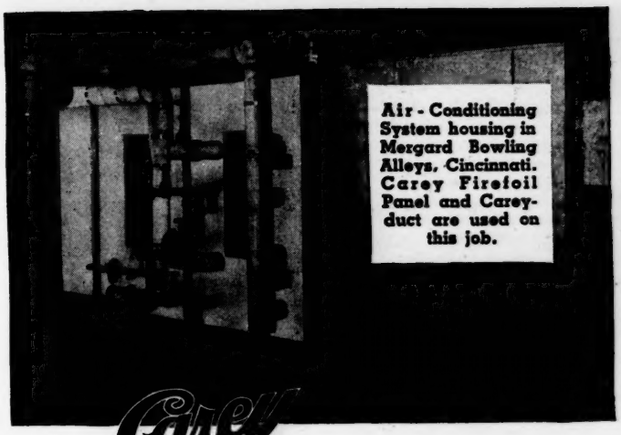
SUMMER DEGREE HOURS

For the third successive summer, HEATING & VENTILATING in this and succeeding issues, is publishing monthly and cumulative totals of summer degree hours on an 85F basis. To obtain these figures, hourly temperatures are used and 85 is subtracted from the hourly dry bulb temperature to obtain the number of degree hours for that hour. The total of degree hours for that month gives the monthly figures published on these pages each month during the summer.

There is some indication that in buildings where there is little internal load, either sensible or latent, such as in residences, a simple proportionality between the number of degree hours and the air conditioning load exists.

Of the 31 cities for which HEATING & VENTILATING computes the number of degree hours, none had any degree hours during the month of March except Houston, Texas, which had one. During April, the number of degree hours totaled as follows: Houston, 4 (seasonal cumulative, 5); Kansas City, 28; New Orleans, 7; St. Louis, 8; San Diego, 70; Savannah, 19.

Cities which had no degree hours during April are: Baltimore, Birmingham, Bismarck, Boston, Buffalo, Chicago, Cincinnati, Cleveland, Columbus, Des Moines, Detroit, Fort Wayne, Grand Rapids, Indianapolis, Memphis, Milwaukee, Minneapolis, New York, Philadelphia, Pittsburgh, Portland, Ore., Richmond, Va., San Francisco, Toledo, and Washington.


Air-Conditioning System housing in Mergard Bowling Alleys, Cincinnati. Carey Firefoil Panel and Careyduct are used on this job.

Carey
FIREFOIL PANELS
for Air-Conditioning Housings

This modern insulating board is unexcelled for construction of housings for enclosing various types of equipment. Eliminates vibration; no rusting; no painting; water resistant; fireproof. Carey Firefoil Panel consists of corrugated asbestos felts, firmly bonded and surfaced on each side with asbestos-cement sheathing. It is strong, rigid, light in weight. Maximum size sheets, 48" x 96". Thicknesses from ½" up.

Increase customer satisfaction . . . add to your profits . . . by using Carey Firefoil Panel on your air-conditioning jobs. Write for Specification Sheet; address Dept. 49.

THE PHILIP CAREY COMPANY • Lockland, Cincinnati, Ohio
Dependable Products Since 1873
BRANCHES IN PRINCIPAL CITIES

THERM-O-TILE
Reg. U. S. Pat. Off.
The Conduit for Underground Steam Lines
SIMPLEST • STRONGEST • MOST EFFICIENT

Monolithic concrete base. No broken stone fill. Strong arched construction. No bell joints. Internal channel drain. Etc. There are 10 other reasons why Therm-O-Tile is the superior conduit system. Treated fully in Bulletin 381.

Sold and installed by Johns-Manville Construction Units in all Principal Cities.

See our page in Sweet's, or, The Heating Guide.

H. W. PORTER & CO., Inc.
823-V Frelinghuysen Ave., Newark, N. J.

Without obligating us in any way, ☐ Please send Bulletin 381. ☐ Send representative. ☐ Enclosed is a sketch, with principal data of a prospective job on which we shall be glad to have your comments or quotations.

Name .....
Firm .....
Street .....
City ..... State .....

NEW TRADE LITERATURE

Dust Control. A standard size, 16-page booklet which presents a complete story of the Roto-Clone dust control in words and pictures. The Roto-Clone is a device which performs the functions of an exhauster and separator in a single unit. AMERICAN AIR FILTER COMPANY, INC., First and Central Ave., Louisville, Ky.

Expansion Joints. A standard size 16-page bulletin J-E1907 on the Yarway Gun-Pakt expansion joints. Bulletin contains information on the construction and outstanding features of this expansion joint as well as information on how to figure expansion in pipe lines and data on prices, weights, dimensions of the expansion joints. A number of illustrations of typical installations are also included. YARNALL-WARING COMPANY, CHESTNUT HILL, PHILADELPHIA, PA.

Fan Blades. An attractive 60-page catalog and instruction manual on fan blades. The publication contains illustrations of a number of different types of propeller fan blades together with detailed specifications and performance characteristics for each. This data is provided to make possible the selecting of the proper fan blade for each application. The first four pages are devoted to a description of a method of selecting fan blades, explanation of fan test codes, and simple fan laws. The text of the catalog is made up of a series of bulletins on the various fan blades in the Torrington line. Included in these bulletins is information on features of construction, fan dimensions, and a series of graphs showing air deliveries and power consumptions as recorded under NEMA code tests. THE TORRINGTON MANUFACTURING CO., TORRINGTON, CONN.

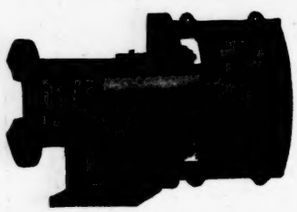
Flow Meters. A standard size 12-page bulletin No. 35-83, illustrating and describing the ADSCO flow meter. This instrument is designed to measure steam, water, compressed air, or high pressure gas. Bulletin describes principle of operation and construction and lists detailed specifications. AMERICAN DISTRICT STEAM COMPANY, NORTH TONAWANDA, N. Y.

Heating Pumps. A standard size, 24-page, spirally bound catalog, No. VCP 240, illustrating and describing the Hoffman line of heating pumps. Bulletin gives information on Hoffman return line vacuum pumps and condensation pumps. Besides containing information on the features and construction, dimensional and capacity data, the bulletin presents a number of installation diagrams showing how the pumps should be installed. HOFFMAN SPECIALTY CO., INC., 500 FIFTH AVENUE, NEW YORK, N. Y.

Refrigeration. A standard size, 8-page bulletin entitled, "New Ways to Cut Refrigeration Costs." Bulletin gives complete information on the Armstrong purger for removing foul gases from refrigerant systems. Includes information on why a purger is needed, how much gas is lost through the purger, how to start the purger, installation recommendations, and prices and specifications. Bulletin also gives information on the Armstrong high side float and the Armstrong automatic trap for draining oil separators. ARMSTRONG MACHINE WORKS, Three Rivers, Mich.

ADSCO INTERNALLY-EXTERNALLY GUIDED JOINT

MOST COMPLETELY GUIDED, DEPENDABLE SLIP TYPE JOINT



Important Features

- Internal Guide on Slip
- External Guide in Hood
- No metal to metal contact between slip and body
- Semi-steel or Steel Body
- Bronze or Chromium plated steel slip
- Properly proportioned stuffing box
- Available in various sizes for high pressures and temperatures
- Lubrication Fittings

Slip is DOUBLE GUIDED Throughout Entire Traverse

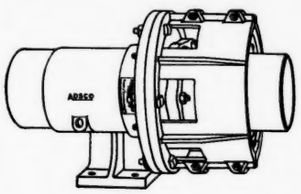
Packing can be lubricated under pressure

Internal and external guides insure true, axial slip guidance throughout entire traverse without metal contact between slip and body. External guide hood protects polished slip surface from dirt or damage. Openings in two-piece hood permit of packing gland adjustment when required.

A properly proportioned stuffing box is provided to accommodate ample packing for high pressure and high temperature operation and the packing can be lubricated under pressure through Alemite fittings to keep packing pliable.

Hundreds of these joints are in daily service in federal, state and municipal departments, public utilities, colleges, institutions and industrial plants.

Write for Bulletin No. 35-20V



Made with Beveled Ends for Welding

This joint can be supplied in single and double slip types with or without anchor base and service connections with beveled ends for use in welded steam or hot water pipe line installations as illustrated above.

AMERICAN DISTRICT STEAM COMPANY

NORTH TONAWANDA, N.Y.

IN BUSINESS OVER SIXTY YEARS

Apartment House Issue

JULY, 1940